

Aviation Week & Space Technology

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April 16, 1962

Trunklines Face
Financial Threat
In Noise Issue

McDonnell Gemini Mockup



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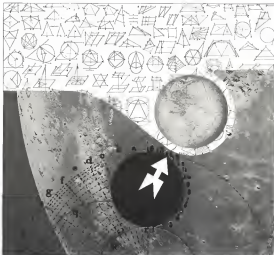
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AEROSPACE CALENDAR

(Continued from page 5)

- Technology Exhibition, London, England
 Space: British Interplanetary Society
 Mar. 3-4—Pan International Congress on Human Factors in Aerospace (HFE, La Jolla, Calif.; Long Beach, Calif.)
 Mar. 7-9—Materials and Processing in Space Transportation Symposium: Society of Aerospace Material and Process Engineers (AIAA), St. Louis, Mo.
 Mar. 7-8—Annual Conference: Society of Photographic Scientists and Engineers (SPE), Boston, Mass. Co-sponsored by AF Cambridge Research Laboratories
 Mar. 7-14—1967 Tool Exposition & Exposition Conference, Public Admission, Cleveland, Ohio
 Mar. 8—Management Conference on Air Being in the Defense Industries (Boston College, Chestnut Hill, Mass. Sponsored by American Manufacturing Ass., Research & Research Research, Boston College)
 Mar. 8-18—17th Annual Symposium on Spacecraft Conference, Mountain View Lodge, Valley View, Washington, D. C.
 Mar. 8—Biological National Conference on Potential Uses of Space (Smithsonian Institution, National Academy of Space Management)
 Mar. 10-12—Western Regional Conference on Traffic Control, Los Angeles (Hilton Hotel, Los Angeles, Calif.). Co-sponsored by AIAA
 Mar. 14-18—National Astronautics Exposition Conference: Institute of Radio Engineers (Baker Hotel, Dayton, Ohio)
 Mar. 14-18—Joint Technical Society (Department of Defense Symposium on Communications From Command, Aeronautics Hall, Colorado Springs, Colo.)
 Mar. 14-22—16th Annual National Conference, Society of Automotive Weight Engineers, Simpson Pavilion Hotel, Seattle
 Mar. 14-18—Spring Meeting, Society for Experimental Science (Washington, D.C. Hilton Hotel, Dallas, Tex.)
 May 17-18—Spring Meeting for Young Engineers, American Defense General Motors Corp., Indianapolis
 May 20-24—Annual Conference: American Ass. of Airport Engineers, Santa Barbara, Calif.
 May 20-24—Annual Meeting, American Space Writers Ass. (Mab Hopkins Hotel), San Francisco, Calif.
 May 22-23—Annual Meeting and Aviation Fair, Seattle, Spokane, National Fire Protection Ass. (Shelton Hotel, Philadelphia, Pa.)
 May 22-23—Second Annual Air Transportation Conference, New York University (Washington Square Center, New York, N.Y.). Co-sponsored by American Transportation Institute
 May 22-25—Flight Aspects: International Symposium and National Flight Engineering Conference, Stanford Park Hotel, Washington, D.C.
 May 22-24—Conference on Solid Rocket Propulsion Systems: Mission of Science and Technology (Chrysler Research Office, Naval Research, American Research Foundation)
 May 22-26—National Microwave Thermal & Technology Symposium: Institute of the Engineers (Boiler Club)
 (Continued on page 9)



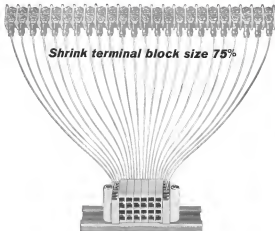
SOLAR ENERGY WHERE THERE IS NO SUN?

When it's accustomed to the age old concept of night and day. Long hours of sunshine, equally long hours of darkness. And so, during Earth Orbit, in the unattended regions of outer space, when life giving rays of the Sun are subjected to a brief period every day. Those unattended, those periods of darkness threaten the feasibility of Solar Powered space vehicles. This is but one of the many challenges confronting Ken Nichols and his associates at Sundstrand Aviation Denver. Ken's Project Manager, guiding the development of a 15 KW (peak-to-peak) Solar Dynamic Space Power System under Air Force Contract. Briefly, the system is comprised of a huge mirror which reflects solar energy into a boiler. Here, under intense heat, liquid metal is vaporized, thus providing an axial flow turbine which drives a generator. Sealing on liquid metal bearings. Sundstrand had to devise a method for controlling the generation of power, when solar energy was blocked out by the Earth's shadow. In some Earth Orbits, night would last only a short period of time. Even so, energy must be stored during this to be used when the solar energy is available. Ken and his fellow workers believe they've solved the problem. They are testing a system which utilizes the phenomenon of the latent heat of fusion. Salts of some metals, when changing from liquid to solid state, release large amounts of thermal energy. This heat provides for continued auxiliary power where there is no sun. The Solar Mechanical Engine is but one of four Independent Space Power Systems for which Sundstrand has been given the responsibility of development. Each day, engineers at Sundstrand are confronted by such vexing problems as the containment of highly corrosive liquid metals, finding adequate material for operating in Zero G environment, and liquid metal journal bearing performance. Still, never let it be said that Sundstrand employees live with their heads in the clouds. They appreciate the permanent, ideal working conditions... Colorado's exceptional recreational opportunities... the friendly, congenial Mid-high surroundings. And most of all, they are enthusiastic about the myriad challenges that confront them daily. Each has the satisfaction of knowing that he is taking an active part in the conquest of space. If it were a qualified space age engineer or technician and would like to meet the challenges of tomorrow, act today! Apply in person or send a resume of qualifications to:



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Mr. A. C. Ford, Superintendent of Engineering,
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MEMPHIS, TENN. • CHICAGO, ILL. • NEW YORK, N.Y.

October 12, 1965

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Superintendent of Engineering

ACF:js
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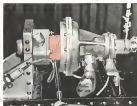
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|----------------------------|--|------------------|------------------|------------------|------------------|------------------|
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| Color | Black | Black | Black | Black | Black | Black |
| Consistency | Sticky | Flowable | Flowable | Flowable | Flowable | Sticky |
| Temperature Resistance | -60 to +300 °F (20 to 150 °C) continuous; -100 to +300 °F (20 to 150 °C) intermittent; -100 to +300 °F (20 to 150 °C) impact | | | | | |
| Specific Gravity | 1.14 | 1.14 | 1.17 | 1.17 | 1.17 | 1.17 |
| Ball Impact Resistance | 100 ft-lb/inch | | | | | |
| Tensile Strength, psi | 100 | 100 | 100 | 100 | 100 | 100 |
| Elongation, % | 10 | 10 | 10 | 10 | 10 | 10 |
| Compression Set, % | 10 | 10 | 10 | 10 | 10 | 10 |
| Volume Resistance, ohm-in | 10 ¹⁰ | 10 ¹⁰ | 10 ¹⁰ | 10 ¹⁰ | 10 ¹⁰ | 10 ¹⁰ |
| Surface Resistance, ohm-in | 10 ¹⁰ | 10 ¹⁰ | 10 ¹⁰ | 10 ¹⁰ | 10 ¹⁰ | 10 ¹⁰ |
| Dielectric Constant, % | 100 | 100 | 100 | 100 | 100 | 100 |
| Dielectric Loss, % | 100 | 100 | 100 | 100 | 100 | 100 |

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April 16, 1962

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Heuse Faces Another Decision on B-70 26
• Approaches grow closer to McHenry position, \$42 million for acceleration of Dyna-Soc is urged

Noise Returns as Major Airline Problem 36
• Abatement costs, cited as penalties by pilots, compressed cockpit, court ruling stir issue

Supersonic Transport Simulator Tested 62
• Effective stability augmentation systems will be needed throughout supersonic transport flight regimes

SPACE TECHNOLOGY
Cosmos 2 Initially Deorbited 37
12th In. Solid Rocket Competition 38
Human Element Stressed by Plans 39
New Study Warns About Space Costs 39
Navy Holds Briefing 40
Military Space Vehicle Set to Call 40
Commercial Towing Drives 41
31 Other Drives 41
Aerodyna Coupling, Power Problems 42
Space Communications, Space Problems 42
New Soviet Launcher Displayed 43
U. S. USSR in Conflict About Tests 43
NASA Funding for Center Program 44
Soviet 3000th Rocketry Technology 45
Soviet Tests on S100 Space Vehicles 46

AERONAUTICAL ENGINEERING
Supersonic Transport Simulator 57
Fifth Stage Film Reorders Time 58
Nuclear Reactor Advanced Construction 59
New Soviet Aircraft Details 60
Boeing Reevaluates Air Condition 61
London Briefing 62
AVIONICS
British Army Weapons Meet Experts 107
Threats to Navy Operations 108
Threats to Navy Operations 109
Navy's New 110
Navy's New 111
Navy's New 112

EQUIPMENT
Cosight Ray Simulator Tested 101
New Aerospace Products 102

EDITORIAL
Noise Versus Safety 30

COVER General arrangement of the two-man Gemini spacecraft is shown in this McDonnell Aircraft Corp. mockup which illustrates considerable reliance on redundancy developed by McDonnell in design of the Project Mercury capsule (AVF Apr. 9, p. 12). To be launched by a Martin Titan 3, Gemini will be flown to develop redundancy techniques and to provide experience in weightless flight in earth-orbital mode of two men or more. Plans will be equipped with ejection seats for escape during a launch abort, and a lift-off-type wing will be placed into advanced Gemini vehicles for landing retrieval.

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Cover: McDonnell Aircraft Corp. 100-200 N. West St., 12th Fl., New York 10011. (201) 327-1000. Teletype: 201-327-1000. Cable: 201-327-1000. Post Office: New York 10011. Second-class postage paid at New York, N. Y., and at additional mailing offices. Postmaster: Send address changes to AVIATION WEEK & SPACE TECHNOLOGY, 100 N. Zeeb Rd., Secaucus, N. J. 07094.

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Noise Versus Safety

After several years of shadow boxing with the airport noise problem and hoping it would eventually dissipate into kerfuffle-coated air, it looks as though the air transport industry now have to face squarely all of the basic issues raised by the increasing decibel levels of its jet-powered fleet. The airport noise issue is certainly one of the most complex legal and technical problems now facing the airline industry. This complexity is well detailed by one of Aviation Week & Space's Tech Source's pilot editors, David Hoffman, in a series of two articles beginning on page 16 of this issue.

There are several aspects of the airport noise problem that bear close scrutiny. Most important is the balancing tactics of some airport authorities that have already forced airport pilots to dip below minimum safety operational requirements and if allowed to continue unchecked will certainly lead to tragedy. London airport and Idle will appear to be the most offenders as this report bears both of these handle jet transports heavily loaded with passengers and fuel for the long transatlantic hauls, an activity that reduces the margin of safe performance of the jet transports either by regulation or basic aircraft limitations is deplorable.

Jealousy in England

At London airport particularly there is an unmistakable trace of the competitive jealousy that followed the introduction of the Boeing 707 transport into airline service. The British press' press campaign against the Boeing 707 was extremely virulent and based first support, if not original information, from British officials still reeling from unsatisfactory explosions of how their own transport planning round the commercial work by each route manager.

At Idleford, the politically sensitive New York Port Authority, simply handled the noise problem with the high handed tactics that characterize all of its operations. Whatever the merits of it now apparent that airline pilots are being pressured into operating long hauls beyond the marginal transports with procedures that fall far below the best safety margin these aircraft are capable of providing. Naturally, there are signs of airline pilots' revolt against this erosion of basic safety standards in the name of safe noise procedures. We thank John Canadi, vice president of Trans World Airlines pilot and vice president of the Air Line Pilots Assn., will find support from the thinking public as well as his fellow pilots for his comments that "We will not move farther in a less safe direction while shoving whether to retreat. We will not turn toward the ground, drop our tanks, climb at steeper angles or throw away thrust—but there are safer ways to reduce noise."

Few aeronautical engineers would argue with Carroll's thesis that there are safer ways to reduce ground level noise than by executing more violent low level maneuvers at reduced power with a corresponding loss of lift at takeoff. Here, neither the manufacturing nor the airline industry has taken a uniformly sound approach to a technical rather than operational solution of the noise problem. One of the biggest allocating factors in reducing airport vicinity noise is the turbine engine. It provides two solutions for the noise problem: a more powerful, per-matching steeper climb-out angles with no reduction in safety standards and thus a less noisy effort. Yet only one doctrine exists—American Airlines has completely converted its jet fleet to turbofan power. There are other turbofan engine designs that can contribute to higher aircraft performance, adding safety while reducing the airport vicinity decibel level. But the airline industry has shown no balancing interest in this equipment.

The airline case against restrictive noise procedures would rest on a far longer and publicly acceptable foundation if the airlines had first done everything technically possible to quiet their jets. It is true that many of these technical solutions are expensive, although the turbine engine in the long run can offer an operational economy that will more than offset its initial expense. But low costs to the airlines now are the only noise procedure in schedule restrictions, packed limitations and increased hazard? And low costs will then become as the future if these airport authority-imposed procedures can be definitively established as the proven or even contributory cause of fatal accidents?

FAA Shuns Responsibility

The Federal Aviation Agency has placed a rather ambiguous role of late in sharing the basic noise issue, shying or gloomily retreating and treated legislation to give aid as appearance of strong safety concern while actually preventing the airport authorities to push their requests beyond the real limits of safe operating procedures.

The air transport industry and the federal regulators, bodies responsible for air safety have been trying to sweep the noise deal under the rug, but we predict the procedure will prove to be ineffective and expensive as the noise problem expands with neglect and around public air corridors on active airports.

There is still some for some aggressive and technically enlightened leadership as the airline industry and the FAA is making a meaningful attempt to alleviate the numerous technical solutions to the noise problem and then move in a solid phalanx on the airport bureaucrats who are content to smother air transport safety to save their own inflated hides.

—Robert Hays

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Owen F. Wilkin, Cleveland attorney, a director of Peacock-Danaher Corp., Cleveland Ohio, receiving the award in 1971.

W. C. Marlowe, senior vice president engineering and maintenance, United Jet Lines, Inc.

Alvin P. Callender, vice president engineering, Lockheed Electric Co., Inc., San Carlos, Calif.

Thomas W. Mennas, vice president engineering and research, SKF Industries, Inc., Philadelphia, Pa.

William F. Fox, vice president finance, RFA Aircraft Corp., Palo Alto, Calif.

Paul Rob. Nelson, executive vice president research, Scandinavian Airlines System (SAS), according to V. J. Rosenbaum, managing.

Albert A. Goldberg, vice president sales, Power Systems, Inc., Waltham, N. Y.

Donald W. Cook, vice president and general manager, Transducer Systems, Inc., a subsidiary of Bell & Howell Co.

Capt. Leonardo F. Top, vice president operations and maintenance, Philippine Air Lines.

Glen Hopkins, executive vice president, aerospace methods group, Dynatec Electronics Inc., Norwalk, Conn.

Paul Hall, vice president operations, Glanville Electronics, Ltd., Vancouver.

William C. Chaudhry, a director and director of planning, California Computer Products Inc., Downey, Calif.

Arthur H. Kelpin, president, the Kelpin Corp., Philadelphia, Pa., according to Harry A. Kelpin, vice president at home club and chief executive officer.

John W. Winters, vice president engineer at American Instrument Manufacturing Corp., Hampton, Tex.

Edwin B. Gamson, vice president, Amper Corp., Redwood City, Calif. Mr. Gamson is general manager of the company's Computer Products Co.

Michael B. Klein, vice president research and development, American Airlines, Inc., Los Angeles, Calif.

Alan C. Johnson, assistant to the board chairman, Aerojet General Corp., Azusa.

Honors and Elections

Chris B. Kachub, Sr., awarded doctorate and engineer has received the 1972 Lewis Thesis Award for his thesis "Aircraft for many years of dedicated effort to improve aircraft safety." In 1971, Mr. Kachub, not a major safety officer in the Federal Design Section of The Boeing Co. Transport Division.

(Continued on page 125)

TOUCHDOWN ON THE FIRST PASS

A new air traffic surveillance system, Texas Instruments ASR-4, provides accurate position information on this jetliner and other traffic within 60 miles. Result: touchdown on the first pass.



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INDUSTRY OBSERVER

► Ninety-day study of Apollo lunar-lander-on-technique (AW Apr. 9, p. 29), being conducted by Lang-Tenace-Vought for NASA, is scheduled to be completed by the first week in June. Among other subjects, study will include development of a one-use lunar "bag" to shuttle Apollo astronauts from lunar orbit to the moon and back.

► Air Force nuclear-detection system (Nucleids) being developed by General Electric Defense Systems Dept. will use optical, seismic and electro-magnetic sensors to define time, place, height and size of nuclear bursts. Nucleids assets will cover about 341,000 sq. mi. will be located in less than 100 mi. of target area. Data will have about 30 sq. ft. of floor area each, and will be built to take pressures up to 50 psi.

► Laser weapon effects will be investigated in a research program by Raytheon's Surface Radar and Navigation Equipment Division under an Army contract expected to be awarded soon. Raytheon hopes to develop theory to predict effects of high-intensity radiation in optical waveguide and to confirm that theory with tests. Army also will soon award contract to Avco's Research and Advanced Development Division for research on the terminal effects of intense electromagnetic radiation.

► Air Force Refueling Systems Division may initiate industry study of means to provide air mobile, medium-range ballistic missile (MURBM) with some protection against enemy attack. One idea being considered is to build a number of consecutively sited "hardened" locations, each in reinforced, shielded and buried, in which the MURBM squadrons could take cover.

► Rocketdyne has about 15 J-3 engines in three J-3 engines in various stages of production and test. Five J-3s will power Saturn C-3 boosters and eight will power Nova test stages.

► Eight Lancer battleboats have been deployed by Arma, four in oceanic locations, completing its production contract with Martin Co.'s Glendale division. First battleboats of the point-to-point attack missile, complete down through field manuals, was exhibited from Orlando in one Lockheed C-119 and two Douglas C-119 aircraft.

► Some characteristics of nuclear explosions in the ocean will be simulated in a new hydrographic technology to be built by Hyatt Corp., Birmingham, Ala., for Naval Ordnance Laboratory. Centrifuge will produce up to 200g in a water tank. Explosive charges as small as one-fifth gram will be detonated and monitored photographically. Data will be analyzed to study formation of water columns, diffusion of nuclear debris and other phenomena. Operations are scheduled to start in early August.

► Italian Anzalone turbo-prop-powered business and sport aircraft prototype designed and partially assembled by Procter in Milan, will undergo final assembly in France at SIPA factory in Paris (AW Mar. 5, p. 85). Procter claims all rights outside France in the license agreement granted to SIPA. Single turbo-prop engine powerplant delivering 500 hp will give the plane a cruise speed of 285 mph at 75% power. Anzalone weighs 5,156 lb., carries four people in maximum range of 994 mi.

► Altitude-chamber tests of the air pumping system for Northrop's laminar flow control test aircraft are about to begin at the Phoenix, Ariz., plant of General Corp.'s Aerospace division. Chamber tests will simulate altitudes of 45,000 ft., and compressor inlet temperatures ranging from -30F to 180F.

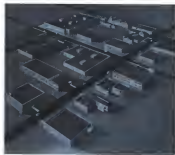
► Site survey work on Kure Island in Japan last week looking at potential sites for a new NASA Test East Data Acquisition Station to be used in conjunction with the Russian N. C. station for geophysical and astronomical satellites. The team earlier looked at sites in the Philippines.

LIBRASCOPE COMPUTER FACILITIES

Shown below is a composite view of Librascope's facilities where a variety of computer systems are currently in different stages of design and production. Some are strategically involved with national defense...others deal with business and industrial process control. Each is uniquely designed to answer a particular need. The success of these systems illustrates the value of Librascope's engineering philosophy. A decentralized organization of specialized project teams responsible for assignments from concept to delivery...and backed up by excellent research, service, and facilities. For your computer requirements, call on the company of diversification in computer technology is unsurpassed. Division, General Precision, Inc., 808 Western Avenue, Glendale, Calif.



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Washington Roundup

Space Funds

Clarens in Cosmos now holds its favorable for space spending that the House Science and Astronautics Committee is expected to go on this week in its final sitting at the National Astronautics and Space Administration's fiscal 1963 budget authorization bill. Much of the earlier concern centered among committee members by the apparent lack of enthusiasm for the space program both in their districts and among favored constituencies in Congress are mollified by the official flight of Astronaut John Glenn according to Chairman George Miller. Rep. Roger Chao, a science Republican member of the committee, says so far so good. "We would have been in real trouble if it had not been for the Glenn flight."

The House committee must to report the authorization bill before the Easter recess late this week. Cuts probably will total about \$100 million, or less than 3% of the \$3.5 billion total. This is likely to include about \$50 million from external space facilities and the Navy program, and \$100 million from the Prospector lunar vehicle.

Another favorable sign came last week in the Senate when the appropriate committee refused the House cut called for the \$55 million from the \$65 million requested by NASA for the fiscal 1963 launch for such key programs as the advanced Saturn and Constellation. The House Appropriations Committee, which gets the NASA budget bill next, will provide the next major test of congressional sentiment on space spending.

NASA Housing Worry

Aerospace companies are scrambling very uneconomically to lessen soliciting their contributions toward the \$275,000 price of a NASA exhibit hall in the Smithsonian. For the letters sent out in the name of the late major reference to a \$250,000 contribution from Dan Koshell, president of Aerojet General Corp. Koshell is heading an informal committee that is trying to help raise the funds. This is being done with the approval of NASA Administrator James E. Webb and Sen. Warren Magnuson of Washington. NASA has no exhibit hall until the year, but no exhibit for construction of a exhibit area. Koshell is chairman of the board of operations of Aerospace Industries, Inc., which has recently taken a stand decommissioning company exhibits.

Contractors testifying on points before the Senate Permanent Investigating Subcommittee (see p. 35) are finding it hard to change the subcommittee's mind on any of its facts and figures. The subcommittee has been reviewing the knowledge given last May and the staff's figures and calculations have been reviewed by the General Accounting Office for accuracy.

Advent Under Review

Advent satellite communications satellite project is undergoing a detailed review by the office of Director of Defense Research and Engineering. It will form a part of the review of the Services of Defense. A report is due in the near future. The review is due in April. The Army-managed program has exceeded original budget estimates. During Defense to tighten the financial review major Advent subcontractors. Slow progress and reduced payload ability of the Atlas Centaur launch vehicle (see p. 35) also are problems. Army is considering reducing the satellite's weight by using size of untested components.

First class of Cuban jet pilots, five of them veterans of previous Cuban air battles and most of them under 35 years of age, has been graduated. Cuba's announcement did not say how many there were or when they were trained, but some Cubans went to Czechoslovakia last year for training in pilots and mechanics, and Russia has supplied Cubans with MIG-17 and MIG-19 jet fighters.

Secret decision to halt production on its latest B-70 bomber has resulted in the transfer of a large number of engineers in Avionics Taylor's design group from the B-70 program to Taylor's supersonic transport project.

Military Space Security

Among the innovations involved in current Pentagon security practices regarding satellite satellites (see p. 35) is the fact that Satellite Security Agency, completed previously in the civilian space agency with the help of North American Air Defense Command and issued publicly, do not even make names for Discoverer, Midas and Samos satellites but do list launching dates, inclination of orbits, apogees and perigees for each one.

Sidelight on security: Defense Secretary Robert McNamara told the House Defense Appropriations Subcommittee that the number of U.S. members on 15-man ground alert is classified, but that is deniable and can be guessed at within reasonable limits by a knowledgeable person. That is definitely classified. But even here, to quote McNamara is most ironic: that a knowledgeable Soviet air official located in Washington can guess the relatively small number.

—Washington Staff

House Faces Another Decision on B-70

Appropriations group closer to McNamara position; \$42 million for acceleration of Dyna-Soar is urged.

By George C. Wilson

Washington—House this week will help determine the magnitude of the B-70 program by voting for either the moderate representative development advocated by Defense Secretary Robert S. McNamara or the original Air Force recommendation to build three additional aircraft equipped for reconnaissance strike missions.

The gesture also puts the House Appropriations Committee, which last week recommended adding just \$72.9 million to the B-70 program, against the House Armed Services Committee, which has recommended adding \$120 million. Potential Kennedy requested \$171 million for Fiscal 1965 to continue the development of three B-70's.

The House Appropriations Committee also recommended adding \$42 million to the \$115 million President Kennedy requested for Fiscal 1965 for the Dyna-Soar program. This \$187 million total compares with the Air Force's original Fiscal 1965 request of \$191 million for Dyna-Soar.

The additional \$52.9 million recommended by the appropriations committee for the B-70 program would be spent for development of high maneuverability for the aircraft. Whether an offensive role can be developed for the aircraft like the B-70 flying at Mach 3 (one of the more questions being debated).

McNamara's low position has been that accelerated spending is not justified until such technological problems as high maneuverability for the B-70 are solved. But such high ranking officials as Air Force Secretary, Eugene M. Zuckerman and Air Force Chief of Staff Curtis E. LeMay have argued that the final decision about B-70 production should not be made until test level

where McNamara ordered dual role development program. "Ceteris paribus," McNamara said, "at no time do I want the present program of program relating to the B-70 or the RS-70 concept but the Air Force felt that the Department of Defense would be sympathetic to a program involving elements of duplication. So that."

Dr. Harold Brown, director of defense research and engineering, has made the possibility of applying an anti-air advantage to the program in the B-70, 1962, thus giving the B-70 a reconnaissance strike capability. Brown told the House Appropriations Committee Subcommittee during its recent hearings that the B-70's ability to be low toward a target and that range side detection gives the aircraft an all-around edge over the faster but higher B-70 in reconnaissance missions.

In the day of the anti-aircraft missile, the ability to be high and fast is not adequate defense, he said, and that he has "as yet been expected to have" a missile capable of knocking down an aircraft like the B-70. "We have not right now," Brown said. The McNamara-Brown position could knock down the B-70.

It is not advocating an RS-70 program, he said, but he is a "very delicate" to look at the action developed for the B-70 and determine if it could be applied to the RS-70. "As personal opinion," Brown said, "in that it will turn out that to the degree the problem of perfecting adequate maneuverability is solved, the RS-70 is equally obtainable. Most of that capability could probably be attained with subsonic aircraft." He said the RS-70's longer range makes that aircraft suitable to the General Thomas B-70 in the type of reconnaissance strike missions requested for the B-70.

The major technological problems facing development of the RS-70, Brown said, is perfecting an airframe which could locate suitable targets on a long-range mission or airplane flying at Mach 3 in 70,000 feet in time for the airplane to react. "I think it is almost certain," he said, "that the RS-70 will be able to do that—partly because of the insulation required in the engine, partly because of the increasing air density and partly because of the inability of the human to make the judgment and to set fire to the target."

When asked if the B-70 will mark the end of bomber development in the Air Force, Brown said that the B-70, Brown said, involves some number of exploration in an area which is specifically to be low and in fact it is can comfortably fit low."

Continued on the B-70 program

in order series (AWM May 26, p. 37, Apr. 2, p. 15). The study ordered by the Defense Secretary, McNamara, is dated to be completed by Apr. 25. President Kennedy requested \$171 million for Fiscal 1965 for the B-70, but the House voted along with the Air Force and voted \$441 million to start the development of three additional B-70's equipped for reconnaissance-strike missions. Under the Kennedy Administration's \$1.5 billion program only three B-70's would be built and none of them would be equipped, either. The first B-70, slated to fly this December, is designed merely to prove the airworthiness of the aircraft. The second to fly in 1965, will test its maneuverability in maneuvers at altitudes of 70,000 feet. The third B-70, to fly in 1964 will have a basic navigation system, including a look-back radar.

Brown said alterations to the Air Force proposal include building four B-70's and equipping a few reconnaissance-strike missions or delaying development of the third B-70 long enough to make an RS-70.

Brown's idea of equipping the B-70 for reconnaissance-strike missions was not approved by the House Appropriations Committee Subcommittee on Air Force operations, which declined the RS-70.

USAF Maj. Gen. David A. Borchert, deputy chief of staff for operations, said that from an operational point of view it does not seem efficient to incorporate radar developed for the B-70 in the RS-70 and to use to make it possible reconnaissance-strike missions. USAF Chief of Staff, Gen. James D. Martin, said that the RS-70, despite the fact that it is a Mach 3 aircraft and has been tested and that the General Electric TF39 engine has successfully performed tests at Mach 3 conditions and beyond those specifications by 35 and had compressions by 1.5%. He said the Air Force sought \$571.5 million in Fiscal 1965 for the RS-70.

Col. James said a company has offered to provide an anti-missile missile for the RS-70 under a fixed-price type contract. He said the missile would be ready before the RS-70 enters service, would be, USAT was ready to fly.

Other information about Defense program development during closed hearings of the House Appropriations Committee Subcommittee was recently released in unclassified form.

• **TFX, VAX aircraft:** Brown said the decision has not been made to proceed with the development of the TFX. The Air Force has requested \$1.1 billion for the F-111A, which the Army Navy Air Force development aircraft (VAX).

Plans call for the Air Force, which is studying the program, to spend \$115.5 million in Fiscal 1965 on the F-111A

Titan 3 Bidders' Meeting

Washington—Bidders' conference on a high-speed Titan 3 rocket for the Navy's Titan 3 missile will be held this week at USAF Space Systems Division Headquarters in Los Angeles with the principal lead rocket engine companies invited to attend.

Most candidates for the stage are engines fueled with hydrogen and oxygen, although both USAF and military have been actively investigating space-rocket engine programs.

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Soviets Orbit Cosmos 2 Satellite

Washington—Soviet Sputnik satellite to go orbiting by U.S. tracking stations for its first two orbits was launched Apr. 6 and received Cosmos 2. Russian officials said the satellite is the first Soviet satellite to go into orbit for the space program and gave few details on its mission.

In the first report on the observations made by Cosmos 2, which was launched last May 16 (AWM May 2, p. 24), the Soviet Union said the satellite is the first Soviet satellite to go into orbit for the space program and gave few details on its mission.

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satellite characterized as "unreliable," "unstable" and "not of military value." He said the VAX would be able to deliver nuclear weapons.

• **Nike Zeus:** Brown said successful tests of the Nike Zeus missile system, which is being developed to intercept Soviet missiles, would be a major step in the development of the missile system.

• **Intercontinental Ballistic Missile (ICBM):** Brown said successful tests of the ICBM would be a major step in the development of the missile system.

• **Intercontinental Ballistic Missile (ICBM):** Brown said successful tests of the ICBM would be a major step in the development of the missile system.

When Cosmos 1 was launched, Russian said it might be tracked and its position determined by the Soviet Union. After Cosmos 2 was launched, this and signals were being received successfully by a network of ground stations in the Soviet Union and in other areas. The mission of the satellite was not explained, but Russian has been attempting to create tracking stations outside its geographical limits (AWM May 3, p. 1).

Cosmos 2 was the first in a new series of satellites which will conduct an extensive survey of space conditions near the earth. The survey, carried out by the Soviet Union, will be carried out by the Soviet Union.

By measuring phase difference and variation in time at ground stations, it is possible to determine the position of the satellite. The Soviet Union has been attempting to create tracking stations outside its geographical limits (AWM May 3, p. 1).

Rolls-Royce to Lay Off 3,000 Workers

Rolls-Royce Ltd. has laid off 3,000 workers from the Aero Engines Division because of the company's present outlook of future losses. The division now employs 29,500 persons.

At the same time, Whitehead-Glenair had off 35 members of its design staff and will lay off 200 more out of the 800 persons involved in that aspect of its business. The 200 actually involved are working on the Argon 500 engine.

Rolls-Royce will be taking such extra efforts to reduce headship to a minimum. It is a Rolls-Royce record, but November 1st the sector was off by 1,000.

Company officials said that since January, 1960, division overhead had been increased by 6,000 percent and the peak level of business was obtained in 1961.

Current contracts, they point out, show a sharp marketing decline with output at the average level of 2750 1960. It is a dilemma, they added.

"Glenn engines are in demand at present because they are a well known and the growth of the company's commercial engine business is well known and in 1960 it is expected for the greater part of Aero Engines Division sales. It is inevitable that the volume of commercial business will fluctuate with order re-employment programs.

The final decision payable will split another round of check in Parliament on the government's policies affecting the British aircraft industry (AW Apr. 9, p. 10) Shipments of Rolls-Royce engines have already approached the Swedish parliamentary delegation.

Need for Human Crew Stressed In Formal Report on Glenn Flight

Washington—Vital need for a human crew in manned and unmanned space flight was emphasized by Maxime L. Col. John H. Glenn Jr. and other Project Mercury officials during the formal report of Col. Glenn's orbital mission in the Friendship 7 capsule.

This report concludes on Apr. 6 in detailed results of the flight were given here before representatives of industry and government, including two Soviet citizens.

Vice President Johnson, chairman of the Space Council, launched the day-long presentation by emphasizing that the significance of the Glenn flight—highlighted in the full public press—was "intermediate details" of the report. He said this was the only one available policy. We have the strength to demonstrate our success in what we do below, and the courage to accept the role."

He said Col. Glenn's flight has raised U.S. prestige, to a high point because it was successful, and it was rare.

In the field of space research, Dr. John A. O'Rourke, assistant chief of the research division of National Aeronautics and Space Administration's Goddard Space Flight Center, made these rapid remarks about Glenn's observations:

- Glenn Effect, the human factor, the astronaut, was at every one of all three sides, probably cause from pure fact taking from the outside of the capsule. Another possibility is water from the cooling system.
- Human head around the horizon

was probably due to reflection of the horizon between the lines of the capsule window. Col. Glenn disagrees with the theory, and said he felt there is some type of solid hard around the horizon. Dr. O'Rourke said "the balance of probability is that the horizon was not due to reflection in the spacecraft window. The outstanding reason for concerning the two is that the inclined windows should have given a ghost image."

Col. Glenn said he feels it important for ground agencies to keep the pilot fully informed in the event of a unpermitted malfunction rather than wait until a decision is made, as was done when it was found the heat shield was loose in the Mercury Atlas 8 flight (AW Mar. 5, p. 18).

Weight Loss

Major physiological changes recorded in pre-flight and post-flight observations of Col. Glenn were weight, which went from 171 lb. 7 oz. to 166 lb. 2 oz., and in the fact that he breathes his hand over his head.

Other observations were:

- Respiratory, 16 breaths per min. before and after flight, and a range of 5-39 during the flight.
- Pulse, 68 beats per min. before flight, a range of 76-114 during flight, and 72 in the postflight examination at Cape Canaveral. The 114 was a maximum reading several min. prior to dropping parachute deployment and capsule parachute descent gear. The average pulse rate

reading was 86, which was raised to 125 after eoracing with engine ends over the Atlantic in his first orbit.

- Blood pressure, 118/90 mm. Hg sitting before flight, and 120/70 sitting at 9:45 p.m., about five hours after landing. Col. Glenn took his own blood pressure 10 times during the flight with a mean reading of 120/90.

The pilot varied 500 cc. of urine shortly before sunset, although he reported the equivalent of only 94 cc. of urine in period appearing during the flight. Specific gravity of the re-collected urine was 1.050 compared with 1.039 at 11:40 a.m. on flight day, and 1.031 at 11:40 a.m. after landing.

Tumbling Sensation

Col. Glenn reported a forward tumbling sensation after his first orbit engine ended, a sensation which had been reported by Capt. Virgil I. Grissom in the Mercury, Redstone 4 flight (AW Apr. 23, p. 28).

The Friendship 7 capsule was at the Atlantic Missile Range 166 days. During which 255 design changes were accomplished. Among the major changes from earlier flight capsules were:

- Rotational control system. Plastic flow seals were replaced by soft aluminum seals in the automatic thrust chamber selected valves. Reinforced heat shields were added to both nose and aft and aft door structure.
- Electrical system. Fuel was removed from the manual shutoff system and fuel valves were installed. Inertor indicator lights were added, and an auxiliary battery was installed for the manual attitude sensor wiring. The short sensor signal was introduced with the capsule sensor signal to prevent the escape tower from releasing the parachute.
- Environmental control system. Cold plate refrigerant heat exchangers were installed to cool cabin heaters, cooling fans and other systems. Changes in O₂ in the cabin 0.25 in. in a day when it was found that small leaks of oxygen passed the larger stress on outer flight structure steel valves replaced aluminum check valves in the bromine-silver resistor cooling system. In climate effects of ammonia, and a heat exchanger element temperature indicator was installed for the vent cooling heat exchanger.

Automatic stabilization and control system. New, simplified with logic in command was installed. Tests were added to test gas power leads and heat blankets to maintain a constant 70°F temperature were placed on the sensors.

Nova Study Winners Must Share Costs

By Edward H. Kelen

Washington—Primary emphasis will be placed on willingness to share costs, experience, and management factors in selecting two or three companies to develop a detailed systems definition and preliminary design of the Nova launch vehicle to be used for single launch of the manned lunar landing vehicle if the method is chosen for the Apollo mission.

Direct cost using Nova is regarded as the principal competitor to the reusable method for manned lunar landing (see p. 12). If reusable was the Apollo role, the Nova vehicle is regarded as necessary for exploration-type exploration. The Nova vehicle under consideration can boost 150,000 lb. into an escape trajectory, or 400,000 lb. into an orbit orbit.

National Aeronautics and Space Administration invited 15 companies to bid for the study (AW Apr. 2, p. 20), and a bidder conference was held Apr. 10 at Huntsville, Ala. (see box below). Bidders are being asked to provide a detailed management plan in program configuration review technique (PERT) details, and to describe their technical approach and distribution of effort on each particular problem.

The PERT plan must show each item and the time between events and also the scheduling of design events.

Costs to Be Shared

Contractors must clearly specify in their bids how much they are willing to spend of their own funds in a cost sharing plan with NASA. The agencies will sign the contracts for \$750,000 each, but also the depth of study, and design detail desired is based on available government funds.

Estimates are that successful bidders

Nova Builders Briefed

Washington—Members of the 15 companies invited to compete for the contract to study the Nova launch vehicle attended a bidder briefing Apr. 10 at Huntsville, Ala. Proposals will be due at Marshall Space Flight Center Apr. 16.

Companies represented at the briefing were Aerojet-General, Bell, Boeing, Douglas, Ford, General Dynamics/Lockheed, Grumman, Ling-Sing-Vought, Lockheed, Martin McDonnell, North American and Republic. Chrysler and Northrup would not compete but did not attend the session.

will have to at least match NASA's funding with their own money in order to conduct a thorough study. Before, however, by NASA will be on a functional basis, so that in effect, the contractors will be spending their own money under close supervision by the government.

It is almost certain that one of the study contractors will get a part of the hardware contract, but NASA was a separate competition will be held for the hardware phase, which should be started before the end of this year.

Two-Part Proposals

Proposals are due Apr. 16 and will be submitted in two parts.

• Study proposal, limited to 75 pages and to detail the bidder's capability to complete the study and its report in six months' time and number of people available and estimated costs they will participate in the study. Background and specific areas of background, previous experience in work of a similar nature, analog and digital computing equipment available, and other technical facilities which would be used in the study.

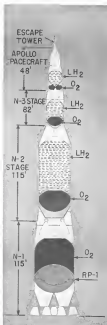
• Hardware phase, limited to 40 pages, showing capabilities to conduct Nova's hardware development. It would detail management caliber and communication in the project, and capabilities of engineering scientific and other technical personnel available, and source of research, test and production facilities, prior experience in developing similar or related space hardware, status and other qualifications in hardware production.

The study will emphasize a two-stage Nova configuration, but the contractors must also show the program will be developed in two stages, in defining the first vehicle for orbit using a two-stage escape vehicle, and the last vehicle for escape trajectories using three-stage and another using two-stage chemical stages and one nuclear stage.

As part of their proposals, companies should specify subcontractors, the work they will do and cost. Marshall Space Flight Center already has under contract the F-4 engine support, M-1 engine support, launch operations and high two and stage and vehicle system test facilities.

Managers will coordinate with NASA and will firm up contract that starts throughout the project.

The hardware vehicle in the basic configuration consists of a booster element of eight Redstone/F-1 engines and a second stage powered by two Aerojet M-1 engines. Contractors have not been for the other stages. De-



CONFIGURATION of 360-ft. Nova launch vehicle is to be studied in detail by two Apollo contractors following a two-point mission which will end Apr. 28. Upper stage and lower landing stages are fueled by hydrogen and oxygen. Booster stage is aluminum and oxygen fueled. Fourth stage is aluminum and oxygen fueled. Fourth stage is aluminum and oxygen fueled. Fourth stage is aluminum and oxygen fueled. Fourth stage is aluminum and oxygen fueled.



Sikorsky S-64 Flying Crane Rolled Out

Sikorsky S-64, scheduled for its first flight in May, was rolled out of the Sikorsky factory at Stratford, Conn. last week. Flying crane heli-copter, powered by two Pratt & Whitney JT40-1 turboprop engines, is designed to carry a maximum payload. Gross weight is 35,000 lb. and useful load is expected to be 28,750 lb. Helicopter is designed for cruise speed of 118 mph.

ays studies will establish comparable and payload performance for the following considerations:

- **Airfoil**—airfoil profile, moment arm of rotorcraft and cargo
- **Earth-airfoil**—payload consisting of a Douglas S-40 stage, which is powered by a single Rockwell 12 engine
- **Specifications** of the best third stage for escape to place the lower landing vehicle into a lower transfer trajectory
- **Nuclear engine stage**—gas powered engine and generator. This stage will be the second gas-turbine transfer unit.

In all configurations the final report will specify engine location, location of passenger compartment and other relevant characteristics. Payload loads in size, weight and mass distribution also should be defined.

Among design choices left open to the contractors are: payload loading,

for individual stages, which depends on the flight method selected, second stage propulsion, fuel dynamics and control and wind conditions.

Although the basic vehicle has a second stage (N-2) consisting of two N-1 engines, the contractors are asked to study and recommend changes in engine number, thrust level and mix ratio.

Work statement calls for a detailed analysis on control, rotor dynamics, basic vehicle structural dynamics and liquid propellant docking. Problems of fuel, construction, engine, and whether tanks should be built as single or multiple units, separate tanks versus a common bulkhead, propellant feed system.

NASA feels that clear answers to these design choices require supporting hardware developments, particularly in these areas:

Working techniques for both remote tank fabrication, high velocity tank and methods bulkhead failure tests and joint configuration design and test of large rollers and load, suspension methods and equipment, and development and test of rotation mechanisms.

Operational Studies

The work statement also calls for operational studies of the Nike vehicle, including test and schedule, manufacturing, transportation and launch, and development and funding schedules.

Ground test and schedule program becomes highly important for the Nike because the first cost of each vehicle prohibits extensive flight tests.

Major test facilities for Nike will be located at the Mississippi Test Area, but test equipment design will depend largely on results of the Nike vehicle study. Contractors will be asked to develop facilities necessary to support vehicle development, test planning, activities and justification.

Detailed manufacturing plans, including determination of major tooling, jigs, fixtures, manpower and floor space requirements will be specified in the study. Major transportation requirements will be on large or ships with loaded study called for in on-distance transport.

A considerable amount of study at all levels has been given to Nike as structure and mission studies (JAN Mar 26, p. 54) and all data from the previous work will be made available to the study contractor.

PERT method is specifically required for detail schedules of the Nike program. Assumptions made to define program schedules and funding must be shown to substantiate as far as possible as the program develops.

ARS/IAS Merger

Phonetic Air—List of agreed principles of consideration may now complete this at the end of a twelve point study committee meeting of the Institute of the Aerospace Sciences and the American Rocket Society.

The list is to be completed internally by the presidents of the two societies for submission to the members at its biennial the next joint meeting in Apr. 28 or 29, Los Angeles. Vice President Eugene Cook and ARS President Dr. William F. Fisher are most concerned to make no mistake, pointing forward to the Institute of the Aerospace Sciences.

If members required inevitably to the list of principles, the consideration process will be submitted to a legal vote of the members of the two societies. The joint steering committee then will set a date for the beginning of operations in a consolidated society.

Two essential questions are how to create a sound financial base for the consolidated society and how many individuals will participate in production. The proposal is to have a subscription for each individual. Each consideration will be the deciding factor in the present two societies and of producing better information is obtained at \$45 per year per member.

Profit Hearings May Bring 'Fee' System

By Katherine Johnson

Washington—Senate Permanent Investigating Subcommittee hearings on defense profits last week pointed toward a solution that would leave a significant defense contractor's profit for support of subcontractors, not a management fee.

The widespread practice now is to put the contractor's profit based on the costs and profits of the subcontractors, as well as a profit on his own work.

This solution to the subcontractors' objection to the situation of what it calls "padding of profits" or "profits on profits" was suggested by Sen. John McClellan, D-Idaho, in a letter to the chairman and Eugene A. Adams, chief of the committee, last week. McClellan also suggested that the contractor's profit be based on the cost of the subcontractors' work, not on the cost of the subcontractors' work, not on the cost of the subcontractors' work, not on the cost of the subcontractors' work.

McClellan's proposal is to require that the contractor's profit be based on the cost of the subcontractors' work, not on the cost of the subcontractors' work, not on the cost of the subcontractors' work, not on the cost of the subcontractors' work.

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The cost of Douglas is about \$900 million. This includes the subcontractors' costs, but not the cost of the subcontractors' work, not on the cost of the subcontractors' work, not on the cost of the subcontractors' work.

McClellan's proposal is to require that the contractor's profit be based on the cost of the subcontractors' work, not on the cost of the subcontractors' work, not on the cost of the subcontractors' work, not on the cost of the subcontractors' work.

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use as a basis in order to report on the situation of defense profits to the committee on the cost of subcontractors.

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more other subcontractors' profits from production or a much higher level of activity on research and development. "You cannot support the defense industry on the profits you pay a research and development industry going from profits on production," Douglas told the subcommittee.

• **Out of the so-called "profits"** that aerospace manufacturers receive, they must first make a higher net expense. He suggested that the subcontractors should re-evaluate their involvement as an outgrowth of the "padding of profit" rather than the "padding of profit."

McClellan argued that the \$61.8 million in "profit" his company bid to Western Electric Co. the prime contractor over the Nike missile program should be considered as "fee." He said Douglas had a breakdown of the \$61.8 million. He listed three items: \$34 million loss and not allowed, against government contracts, which the company had to meet out of its \$61.8 million.

• **Interest**—\$1.5 million. Douglas said that the company had to pay interest on the \$61.8 million. He said that the company had to pay interest on the \$61.8 million. He said that the company had to pay interest on the \$61.8 million.

• **Advertising**—\$2.1 million. Douglas said that the company had to pay advertising costs. He said that the company had to pay advertising costs. He said that the company had to pay advertising costs.

• **Research**—\$1.5 million. Douglas said that the company had to pay research costs. He said that the company had to pay research costs. He said that the company had to pay research costs.

• **Development**—\$1.5 million. Douglas said that the company had to pay development costs. He said that the company had to pay development costs. He said that the company had to pay development costs.

• **Production**—\$1.5 million. Douglas said that the company had to pay production costs. He said that the company had to pay production costs. He said that the company had to pay production costs.

• **Profit**—\$1.5 million. Douglas said that the company had to pay profit costs. He said that the company had to pay profit costs. He said that the company had to pay profit costs.

Western Electric Defends Nike Work

New York—Western Electric Co. did "not pad" its profits on the Nike missile program and its work was "reasonable," President H. E. Brown, Jr., said in a letter to the subcommittee.

"The profit we earned on the Nike work was earned for our own company's share and not part of it is specifically allocated to the lots and pieces of the Nike program. Only a president would see his simple point of view as the change of profit producing from collapsing sales."

All profit figures resulting from the subcontractor are more than the actual profits earned since they had to reflect federal taxes, he said. Brown suggested that the subcontractors should re-evaluate their involvement as an outgrowth of the "padding of profit" rather than the "padding of profit."

[illegible]

13

the aircraft, some expert opinion and FAA. At Idlewild, for example, one mass takeoff procedure from Runway 31L calls for a 20-ft left turn to a 250 deg heading.

Unsettled for its concave that procedure are included in the pilot's operating manual. A sign at the take off end of the runway appears that it should be done. The controller who directs the flight for takeoff tells the pilot. "In the event of some short delay, do not delay more than 200," or according to some pilots "begin your turn immediately" or "begin in 10 sec." If the takeoff is delayed while the Pilot of New York, New York, considers an excess number of "protected" noise profiles (PNDs) the captain is told to "move 30 ft to the left" or "begin taking off at 200 deg."

A similar situation prevails in Las Vegas (NV May 19 p. 42), where TWA and Pan American are competitors, and where the government allows even less noise than the Port Authority. To avoid an pilots are to "hold, hold, hold" until TWA sends them letters that read: "First Flight 107/29, December, 1961 recorded a noise reading of 106

DBS or better, with a reported wind of 100/16 knots temperature 55.0°F and a takeoff gross weight of 55,000 pounds."

The issue faced needed for this flight is considerably in excess of the maximum allowed by the Air Mass by 110 PNDs (noise) and 103 PNDs (noise).

Even expert, including the noise statistics which contributed to this an unusually high noise level is requested at your latest opportunity."

Under FAR 91.13, which took effect on Sept. 25, a pilot who does not follow an FAA approved performance manual also may be ordered to "hold" until 48 hr. a full description of his reasons to face FAA authorities. When the FAA hearing adjourned last month Capt. T. J. Reichold, chief of the Port Authority's Eastern Region, called for a "complete review and a conclusion" of Idlewild's noise problem. In a letter to Warren Handcock, a deputy assistant FAA administrator in New York, Reichold called that the noise transmission "In the interest of noise abatement do not delay from 200 deg." to dissuade at Idlewild.

Handcock replied that New York authorities and ATC separation procedures are being reviewed. FAA, he said, would set a meeting that month to report on the environmental philosophy and discuss whether it should be retained, deleted or modified.

Although somewhat noncommittal, Idlewild's Runway 31L, which the air mass takes to 200 deg. a reported 14,600 ft long and last year accommodated for 66,679 departures or 49.1% of the airport's total. The Port Authority, an addition does not permit jet aircraft between 10 p.m. and 7 a.m. unless they can be made from a runway that was the aircraft over water.

Unless it turns to 200 deg. it begins about two-thirds of the way down 31L, an Idlewild pilot fly directly over the densely populated village of Floral Beach, Long Island. And a spokesman for the Port Authority told Aviation Week that if the pending procedure was stopped, just one of the airport's longest runways would be banned at night.

(This is the first of two articles on airport noise problems. The second will appear in a subsequent issue of Aviation Week.)

National Stock Option for Maytag Report

Washington—Option to purchase the National Aeronautics stock of Board Chairman George V. Baker at above-market prices appears to have acquired by Louis B. Maytag Jr., former president and majority shareholder of Frontier Airlines.

Though Baker's holdings do not represent a controlling interest, such a sale would ensure Baker's competence for Maytag to gain a voice in management of the airline.

Baker told Aviation Week that he would prefer "don't see another" proposal report that he has been negotiating the sale of his 50% interest in National Airlines to Maytag. Baker added that he would be willing to "sell anything for the right price."

Maytag, who recently sold his 67% interest in Frontier to the Goldfield Mining Corp. for a reported \$3 million, was available for comment and has also reportedly denied any knowledge of the transaction with National.

Unless announced by either Baker or Maytag, details of the alleged transaction could remain undisclosed until the middle of May. There is no record of a large stock sale by Baker or the registration of any holding in National by any party in the Securities and Exchange Commission files. SEC spokesmen point out, however, that if the sale has been made the commission's statistics would not require a filing before May 18.

Carl Rosenbaum, Board reporter, says that Baker owns 104,042 shares of National's authorized 1,915,321 outstanding shares, plus \$440,000 of the company's net of \$14.2 million in 9% outstanding convertible debentures.

In addition, Baker's wife, Mrs. W. B. Maytag, owns 10,000 shares of stock and \$746,700 in debentures, according to the airline's 1961 proxy statement.

Baker resigned as president of National last November, but remained as chairman of the board, and selected his nephew, Robert E. Weiland, as president.

In further development last week, a former National vice president, Lewis W. Drennon, was elected president and director of Frontier Airlines at a stockholders meeting in Denver. Drennon is Baker's chairman of the board of Goldfield Mining, which has controlling interests in Goldfield Mining and Wilco A. Swan, president and chairman of Goldfield and Griffith, a subsidiary of the mining companies, were named co-chairmen of the Frontier board of directors.

Maytag has designed the aircraft to carry high speeds.

The wing is designed for a maximum Mach 0.85, design number of .54 so that stability augmentation and compensated flight control mechanisms will not be needed. Swept-back and elevator control will be direct air-lifted, no-lift system using aerodynamic lift. The stabilizer will have dual, tandem hydraulic actuators with a mechanical backup. Engine driven pumps with electric pumps for backup will supply hydraulic power. Electrical system will be air using engine driven alternators. Flaps, spoilers, landing gear and main wheel steering will be hydraulic powered.

- Success factors include:
 - Maximum gross weight, 68,500 lb; maximum landing weight, 65,000 lb; operating weight empty, 42,157 lb; and zero fuel weight, 48,000 lb.
 - Fuel capacity, 3,625 gal.
 - Fuel burn, 1,900 lb/hr, 17,930 lb/hr.
 - Rate of turn, 2,900 ft/sec.
 - FAA takeoff field length at maximum gross, sea level, 5,820 ft; FAA landing field length at maximum landing weight, sea level, 5,130 ft.
 - Landing speed, maximum landing weight at 125 ft/s, 129 mph.

Early Action Doubled On President's Plan

Washington—Aviation Week has adopted a "wait and see" attitude on President John F. Kennedy's transportation message (AW May 9 p. 42) on the assumption that little, if any, action can be expected in the proposals this year.

Only the President's formation of a special senior government committee on the development of civil aviation is regarded as a new development by the carriers. The balance of the recommendations, they point out, are already in the form of bills now awaiting action in Congress. Most carriers doubt that there is sufficient time for congressional action on the measures and predict that

they may be held over until next year, or even shelved indefinitely by the many other transportation recommendations.

While the industry generally approved the President's emphasis on legislative action, it expressed concern over the opposition of the merger committee. Further, they noted government regulations, they stated, the industry of this committee would serve to "add another layer of bureaucracy" over the present authority of the CAB.

In addition, other spokesmen contended, the committee's appointment could result in making more than an "after-the-fact" move to the CAB's current consideration of a proposed American Airlines for Lines consolidation can be expected to establish acceptable criteria for a future merger proposal within the airline industry.

Kennedy's emphasis on lower air fares to increase traffic volume also appears to clash with other aspects of the message recommending heavy federal support for airlines. The CAB is operating the federal airway system and a 50¢ tax on all airline tickets, many operators feel.

On the one hand, the financially distressed airlines face the prospect of significantly higher expenditures, even though the fuel tax proposals, the latter point out.

Repeal of the 10% transportation tax, also suggested by Kennedy, is particularly felt by operators of the tax on tickets.

On the other hand, they think, the industry is asked to meet these rising costs by changing lower fares, despite their profitable experience with low fares.

While the President's plan for a sharp reduction in the airline's total subsidy bill brought no unified objection from the airlines that expressed concern that any reduction of the present just-in-time subsidy allocation might cause the failure of many airlines.

The President outlined CAB legislation which would make domestic trunk carriers ineligible for rebates on the future, and called for a sharp reduction, and increased termination of rebates, for the best service airlines and helicopter operators.

Several airline spokesmen contended that the elimination of rebates for trunk airlines has long been expected and that it was anticipated the President might recommend a termination of subsidies for the best service before the current high of the current high of subsidies, and that of profit potential in the foreseeable future.

However, they questioned Kennedy's direction to the CAB to develop, by June 30, 1963, a detailed program of "reduction, but not total termination," of rebates, "with annual targets."

Douglas 2086 Fate Hinges on 125 Orders

Long Beach, Calif.—Douglas Aircraft Co. recently received a tentative order for the Model 2086 short haul, transport aircraft designed to operate economically at lower speeds of 250-300 mph (AW May 22 p. 48).

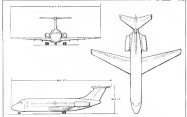
Designed as a light turboprop aircraft with the first version to be delivered to a customer in late 1964, a Douglas official said that the company would not proceed beyond the present two business design stage until five orders for 125 Model 2086s were on hand. Mid-market is the latest date, for going to meet the 1965 delivery. A light engineering, production and flight test schedule will be necessary in order to bring the 2086 to customer delivery in the same time interval as the new propeller aircraft Corp. BAC.

Proposed powerplants are two 60-900 hp short take-off, Whitcomb JT10 A-6 turboprop. Development cycle of three engines, Douglas said, is parallel to the development schedule of the airplane. An alternate engine could be the Rolls-Royce, Sp. 101B-2 which is in the same three category.

Maximum takeoff weight of the Model 2086 is 68,500 lb. and fits in all other specifications are very close to those reported earlier. Average cruise speed is a typical flight stage at 25,000 ft, is 510 mph or Mach .76. The design philosophy is to keep the maximum speed at a sustainable level and concentrate on low speed handling.



MODEL 2086 requires four hours production time and brought forward, and discussed several delays, compared with earlier design. Full-scale mockup is shown.





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CAMERON'S MOLYBDENUM FORGINGS

Big 1962 Atlantic Traffic Gain Doubted

By Glenn Gorman

New York—Despite more predictions of greatly increased traffic on the North Atlantic this coming summer season, the industry's chances of recovering from a disastrous 1961 peak period were doubted with uncertainty last week.

Group line decisions by the Civil Aeronautics Board are expected momentarily. But while some carriers have voiced the lines if approved, would provide a strong stimulus this season, others felt the impact of the new plan for this summer at least might have been lost by the delay in selling it.

Advance bookings in general show no significant increase over last year at this time, although there are many reasons. However, airlines say that the trend is later and later bookings are increasing and advance bookings are a poor indicator of prospects for the season. Further, while the bookings picture this year has been complicated by the uncertainty over whether group fares would be available during the summer for those who wished to take an early stage of travel.

Traffic for the first quarter of 1962 was up 10% over the same quarter of 1961, but load factor was off 3%. In the 1962 quarter, both March and April, the scheduled airlines carried 561,941 passengers and offered 76,997 seats to both continents, a capacity increase of 25% over the same period of last year. In first quarter of 1961, but had carried 593, and capacity was up 47% over the first quarter of 1960. Load factor for the 1962 quarter was 73%, for the 1962 quarter had factor was 47%.

The strong increase in seat capacity last summer—57% for the June through September peak period—is which is to be repeated this year, says the industry. It made that fall suggest in 1961. Given any significant increase in traffic there, fare level rises should not reflect in the fall but year.

Capacity Increase

Over all capacity increase this summer over last, as Airlines Week survey indicates, should range between 15% and 20%.

Some airlines report strong response to the group fare plan. Pan Am, for example, in early last month had had about 20,000 inquiries and made 10,000 reservations. But most of the reservations are conditional on CAB approval. The Board approved the plan only through May 31, held hearings earlier this month and was expected to make a decision on extending the lines by late last week.

Pan Am's first group, 12 executives of

a Denver club booked through a travel agent, was scheduled to leave yesterday for London, where executives would discuss British Overseas Airways Corp. on about seven a group. Trans World earlier this month had booked—conditionally—271 groups totaling 9,186 seats for the summer.

In its presentation to the Board, Pan Am estimated the group plan would provide a 10% increase in traffic to the Atlantic annually for that airline, some 40,000 passengers. TWA estimated it would carry 15,000 passengers this year under the plan, of whom 10,000 would not make the trip if the plan were not available.

But some airline officials feel that the timing of the plan—over summer—CAB approval for the summer—has raised chances for it to make a big success this season. International Air Transport Assn., also being studied for some time, is now working on a low agreement for this year, likely approval the plan for groups of 25 or more only as early February. It was at that time that the first promotional efforts were made. Pan Am's CAB call date of May 31 and the timing was held and a decision reached. According to one view, IATA is at fault because a decision should have been made early enough to allow groups of time for CAB to study the plan.

Advance Effect

One official suggested that the delay and movements involved in the group plan might result in a significant effect on the season as a whole, because personal capacity, not being sure, whether they could book under the plan might be somewhat discouraged with the idea of a significant trip and decide not to go at all.

There continues to be some criticism of the plan as a demonstration but with continuing delay, IATA, subsequent to its approval of the line, would be a success spelled out more precisely, how a spontaneous group should be offered.

A group formed when all the persons of which it is composed are assembled for purposes including that of the formation of a travel group. Its formation must not have been referred to previously in writing of any kind including personal notes or letters. It must not have resulted in whole or part from advertising by telephone, from oral solicitations other than that directed unambiguously to the person assembled for purposes including that of the formation of a travel group, or from use of any other mode of public communication including public address system, radio, telephone, or television.

In the view of some officials, the travel agent is put in a position where he must book the travel for individuals in the first place to any in business.

Be and large, however, most officials believe the group fare should have at least some beneficial effects on traffic this year.

Airlines estimates of the season's probable traffic vary considerably, but most foresee an improvement over last year. Among the airlines making up the group fares if approved, or an option in the U.S. and European economies, less publicity concerning the U.S. balance of trade which has been noted last summer. In travel to Europe last year, increased political tensions and an accelerated decline in travel.

Airline Prospects

Here are some individual prospects for the season.

• Pan Am's capacity will rise about 14% this summer at the peak, with 18% seats flights in both directions compared with 17% flights last year. The airline is estimating a 20-25% increase in its summer traffic. Pan Am expects to have received two or three of its 707-121B jetliners Boeing by the peak and will use them in a step-wise basis to flow increasing the trend to increased service at points other than New York, the airline this summer will operate increased frequencies from Baltimore to Pan Am Philadelphia, and will transatlantic schedules from Detroit and Chicago.

• Trans World Airlines will increase capacity by about 15% with 92 weekly flights in both directions during the season's peak period. Traffic forecast is for a 30% increase. Among TWA's reasons for optimism are an increased jet fleet for domestic and international operations, the direct group fare package, better service for the traveling business. TWA also believes its new, optimistically designed seasonal looking at leisure scheduled to open next month, will attract summer and stimulate customers for TWA. The airline's 1961 international passenger total registered a decline from the previous year, as a big percentage increase would not mean as much as absolute terms as would such an increase from some other carrier. TWA had some 700,731 jet on the Atlantic coast last year, this summer will schedule 12 jetliners in group fares could large reductions in TWA's charter capacity, which sets TWA, because it had no comparable market for Atlantic charter TWA's traffic has shown an in-



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more for lack of the past six months over the same months of the previous year, with an administrative passenger mile increase of 28% for the period.

• **Air France** is predicting a traffic increase for the season of \$19%, with a capsule rate of about 12% to 15% seats each way during a peak period work. Early bookings for June, July and August are up 10-15%. Air France is scheduling a new Chicago Paris non-stop service and a new Houston-New York Paris service.

• **BOAC** will schedule 146 flights in each direction during a peak week up about 6%. A 10% or more increase in traffic is forecast. BOAC's capsule rate is up about 21% last year so an improvement in load factor is anticipated this summer. Bookings are slightly ahead of last year. The airline said if CAA approves the group fare, a considerable increase in business would result.

• **KLM Royal Dutch Airlines** anticipates an increase of 20% in transatlantic increase for the season. Bookings are slightly ahead of last year, and a number of people concerned in group fare may be waiting. KLM's frequency will total 25 each way in a peak week of which one daily flight will be on all seasons. DCA's last summer the schedules were the same except for one less air flight week.

• **Lufthansa's** capacity will be up to 75%, depending on how traffic develops. This should range from 7,000 to 7,100 seats in both directions during a week of the season's height.

• **Scandinavian Airlines** system will hold to 21 weekly round trips at New York, increase to Los Angeles flights to be on a total of seven. Bookings for June and July are lagging while the group fare question is decided. SAS had about 2,000 group fare seats booked when the act of last came.

• **Airline** is predicting a 40% increase in traffic with a 15% rise in capsules, to 24 flights each way in a peak week. Bookings, though late, are up 10% in June, believe in position on the Atlantic competition as capsule travel able this year with a weekly nonstop to Rome and daily service to London. It also is moving the Chicago gateway this year.

• **Trans-Canada Air Lines** is increasing its all-DC-6 service from 21 flights to 24 in each direction. TCA expects an unexpected heavy demand for travel under the group fare plan, which the Canadian Air Transport Board did not set a cap rate for in its old CAA. TCA said it had some extra DC-6s available this year for charter, and several charters were cancelled as fear of group fare bookings.

Electra Crash Award

Houston, Tex.—Attorney for Lockheed Aircraft Corp. and Allied Division of General Motors last week selected that they would accept a verdict by a Houston district state court jury that the two companies were negligent in the crash of a Boeing 707-120 Lockheed Electra at Dallas, Tex., in 1970. The jury awarded \$100,000 in liability to the accident and recommended an award of \$200,000 to the plaintiffs in the suit. Mrs. Suzanne Quick, whose husband was killed in the crash, Mrs. Quick had asked for \$100,000 in her suit against Boeing.

The airline had filed cross-motions against Lockheed and Allison.

The decision may set a precedent for some \$50 million in other lawsuits now pending in courts in a number of the field. The crash and a crash of a Northwest Airlines Electra at Telford, Ind., in 1968 and its possible follow-on claims, had by operations of the Electra who had filed lawsuits in a number of jurisdictions within phase on the airplane by Federal Aviation Agency pending modifications of the Electra's wing.



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Eastern Files Revised Excursion Fare Plan

New York—Eastern Air Lines has filed a schedule of tentative excursion fares which will replace the broad package proposal it had made to Civil Aeronautics Board in February (AW Mar. 5, p. 20).

The broader package, the Board had indicated, contradicted its earlier acceptable because of competitive airplanes.

National and Northeast have filed somewhat similar tariffs. Under the new schedule, round-trip day or night air coach New York-Miami fare will be \$99 during the spring and fall periods and \$111 during the summer peak between June 15 and Sept. 1. This distinction between the fall and "peak" season travel periods was a feature of Eastern's original proposals to the Board.

Present comparable day coach fare is \$145.10. New fares apply Monday through Thursday.

National also has filed for a single aircraft excursion fare with a New York-Miami round trip for \$99. The company would provide a minimum and maximum number of days for the trip.

Also a feature of the plan is a half-fare rate for children, between the ages 2 to 17 accompanied by an adult. This also was a feature of Eastern's package proposal.

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In creating a heavy-duty transport helicopter that can really live with the troops in the field, the designers of the Boeing-Vertol HC-119 Chinook probed deeply into the negative aspects... the problems and headaches encountered under rugged conditions, far from ground support facilities. By overcoming these factors one by one, they have arrived at a positive ease of maintainability. Thus, the HC-119, already recognized for what it can do, also merits consideration for what it doesn't need. For instance...

- No requirement for daily oiling or other greasing.
- No need to operate valves or levers for system checkouts—internal APU actions.
- No need to check left and right engines, main landing gear and fuel cells—they can be installed on either side.



- No need for checking dipsticks—fuel levels appear at sight gauges.
- No overhauls or lifelines needed for inspection—integral straps, winches, etc., are provided.
- No need to climb ladders, use tools, or access panels—they're built into the aircraft.
- No need for vehicle access to change major components—provisions are included for portable, headpowered hoisting device.

- No supplemental power unit needed, even at -45°F. Internal APU is provided. Main engine starting is accomplished hydraulically from the APU.
- No special tools or ground equipment needed for organizational maintenance.
- No need to unload cargo or equipment interior. Load for inspection or servicing—there are no systems under the floor or behind the blankets.



All in all, the HC-119 is just about the most self-sufficient helicopter conceivable... its ease of possessing outstanding payload and performance capabilities.



Hughes' Past Management Barred As Northeast Control Case Issue

Washington—Hughes Tool Co.'s management of Trans World Airlines' helicopter leasing contract in a three-year leasing trial will not be reviewed in the Hughes Tool Northeast Airlines Control Case (AW Apr. 5, p. 41), Civil Aeronautics Board Examiner Merril Reikes advised last week.

In his ruling, Reikes and the present case is whether it is better for the staff control operator to control Northeast or for the airline to be handicapped. During appeal of Hughes Tool control, Reikes has said that instead, in the only thing that could save the airline. So far, both Northeast and Hughes Tool operators at the hearing have denied such notice of leasing liability.

The ruling could strengthen considerably the position of Hughes Tool in its bid to gain control of Northeast. However, CAB Justice Counsel Paul Y. Seligson told the examiner the ruling might be impossible for the Board to make an "intelligent" decision on the basis of record.

Seligson told the examiner that the question was whether the public interest in keeping Northeast alive outweighed interest in obtaining honest, accurate and efficient management for the air transport system.

Seligson has consistently held that the only way to determine how Hughes Tool would manage Northeast, should CAB allow it to take control, is by examining Hughes Tool and Howard Hughes' management of their other aeronautical interests, notably TWA.

At present, TWA and Hughes Tool are locked in a 300-million-dollar suit over a New York district court over alleged attempts to force TWA to buy Hughes Tool equipment and control changes that leaving substantial control to gain control of the airline (AW Feb. 19, p. 47).

In a letter to the examiner last March, Seligson said he wanted to cross-examine certain key witnesses from TWA, Affix Corp. and Hughes Tool to determine whether Hughes or Hughes Tool had run TWA in an efficient and economic manner.

He said he believed the examiner would then find Hughes Tool retained personal control of equipment maintenance, design, acquisition, and disposal.

In addition, Seligson said, he believed the examiner would then find Hughes Tool retained personal control of equipment maintenance, design, acquisition, and disposal.

As a result of the ruling, Seligson said the examiner that he will probably

not ask for witnesses to be called. Seligson's letter to the examiner and his ruling just passed judgment on TWA, Flight 11, which, past executive director of Affix Corp., which now controls Northeast, and several other key TWA and Hughes Tool officials at possible witness.

Reikes' decision, however, was not a precedent-setting decision and a decision of Hughes Tool, notified that in May, 1960 TWA began planning a Northeast merger. The merger would have passed through several studies and management changes, culminating in a Hughes Tool offer last May to exit its money troubles a Northeast merger would cost TWA.

Holliday and the merger plan was shelved after last Aug. 13, when TWA, long money and on a cash basis, lost its money and on a cash basis, lost its money and on a cash basis, lost its money.

Holliday and that during the past TWA Hughes Tool litigation it is unlikely that Hughes Tool would try to organize a Northeast merger with TWA.

Holliday, however, Hughes Tool's chief contention that it control is approved, the company will provide as follows: "Financial assistance consistent with sound business principles."

Seligson told the examiner that if Hughes Tool were to present a firm financial plan that would cause the court to suspend its independence and if it were accompanied by strong proof or some investigation to guarantee the airline's independence, but position would strengthen considerably at position.

Morse Urges Probe: Backs Supplementals

Washington—Congressional anti-trust subcommittee was asked to conduct a wide, public investigation of the airline industry last week by Sen. Wayne L. Morse (D-Ore.) who charged that pending legislation on the placement of airlines is just a "blue print" designed to create competition and provide a monopoly over domestic air routes among "five super carriers."

In a Senate speech, Morse argued that Congress should return to the original intent of the competition act, which was to provide for the competition on the part of new entrants to struggle from "what they have been passing up in both Congress and the Civil Aeronautics Board since the national program change conditions are domestic ones."

During the 15-year history of the regulated airline industry, Morse charged these events with being the first to establish the five transportation and other monopolies about the needs of airlines. He said that the airlines had been so successful in the competitive bidding on the part of new entrants to struggle from "what they have been passing up in both Congress and the Civil Aeronautics Board since the national program change conditions are domestic ones."

BEA Opposes Awards

London—Former independent airlines are directly competing with the state-owned British European Airways would have BEA into the air, Anthony H. Moberg, chief executive said last week.

According to his Airline Industry, competition followed by last BEA's rapid expansion of its international and continental routes to the airlines' (AW Jan. 26, p. 45). Moberg said that the airlines would have a 75% share in BEA's had before.

The airline's secretary, Henry Black, who also pointed out that BEA is not financially committed to nearly 1500 million for new growth, mainly due to the fact that the airlines are not ordered 20. He contended the Air Transport Licensing Board had disrupted this capital expansion.

In another testimony, Gerald Gifford, counsel for British European, suggested that the granting of the routes-44 to the new British and 15 domestic would mean a loss of 44% of BEA's total international traffic.

competition bill which gave the supplemental current government operating authority. The main point of contention was the liberalizing of powers and provisions relating to the airlines, provided by the British, as opposed to most, restricts and imposes authority on the British side.

Morse said the airline industry is at a "state of total collapse," and emphasized that while he did not support any nationalization, he was concerned about the possibility of a concentration of power in the airline industry.

It is this which most greatly concerns me," he said. "That we are not reducing the last set in the closing of the six to five carriers and the nationalized airlines of the airlines to reduce the public competition through the acceptance of loans to the airlines and through introducing competition between the airlines and the operating companies."

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AIRLINE OBSERVER

► Merged summary list compiled by a board of arbitrators for United and Capital Airlines' pilots does not include United flight engineers, one whom the board had at first so paralytic. Until June 1, 1966, both by law and agreement will be classified on a percentage basis. After that date, only summary will govern which pilots fly the heavier jet type, the arbitrators ruling said.

► British Aircraft Corp. is planning a long-range BAC 111 of the 50,000-B class to meet the varying needs of North American operators, which the manufacturer estimates represent a market potential for 250-300 of the aircraft. The larger version of the triplejet aircraft has already been offered to Australian operators.

► Ethiopian Airlines is entering completion of a \$12 million loan agreement with the Export-Import Bank to finance two Boeing 730 turbojets. Part of the aircraft will be delivered in November, to replace the carrier's present DC-8s in service to Europe. A credit of \$1.8 million from the U.S. Agency for International Development, to cover the cost of jet overhaul and support equipment, depends on formal signing of the loan agreement. AID also is providing \$20 million for additional station facilities within the country and improvement of existing facilities.

► Riddle Airlines now reports that Whitworth Gloster has put "its full support" behind the seven AW 650 Agony fighters purchased by the carrier to "expand the current service facilities, increase equipment and provide alternate spare and technical assistance." Earlier, Riddle claimed these problems were responsible for its inability to achieve a high Agony utilization rate on Logan routes operated by Military Air Transport Service (AW Mat. 12, p. 39).

► Tension over Berlin air corridor standards has caused the British government to request legislation for air traffic entering the Communist-dominated territory. Beginning May 1, all British airlines must submit to the Ministry of Civil Aviation advance data on proposed corridor flights. Meanwhile, East Germany contends that such traffic is illegal on grounds that agreements for air travel into Berlin were not made by the governments concerned, but by their airlines.

► Russia hopes to gain a dominant position in international aviation by 1980 with a heavy concentration of service to most of the capital and larger cities of the world. Aircraft predicts it will be flying "64 to 70 times" as many international flights by then, as compared with an expansion of "15 to 20 times" its present domestic service.

► Transair's bid to take over representation of 2,100 International Air of Manhattan members at Northwest Airlines brought about a new contract agreement last week, after the announcement of IATA's airline division head, Frank Heron. Terms of the contract, which do not include flight requirements, are subject to ratification by the members. Contract details were not announced.

► British Minister of Aviation Peter Thorneycroft apparently is winning an argument over night jet flights from London Heathrow Airport (AW Feb. 5, p. 45). By limiting jet movements between 11 p.m. and 7 a.m. to only 1,500 during the period between Apr. 1 and Oct. 31 and ruling that the estimated balance of 500 must depart from London-Gatwick, his bid has forced British European Airways and other operators to cancel or schedule a high percentage of their Heathrow operations.

► Allegheny Airlines' interest in a General 440-540 replacement is declining as the Douglas Model 2036 and British Aircraft Corp. 111 two-jet, jet-range transports. Allegheny will reequip with Comair 440s while it retains 440s to D. Wayne & Son (AW Mar. 12, p. 32). BAC 111 or 2036 would be acquired about 1964-65 if possible, according to current plans.

SHORTLINES

► Allegheny Airlines has begun a no-intermediate nonstop service between Washington-Philadelphia and Philadelphia-Boston in four rotations of 13 and 20% respectively. Washington-Philadelphia fare is \$10 and Philadelphia-Boston fare is \$11.81, both plus tax. The airline operates 15 flights daily during the three cities.

► Delta Air Lines will begin through plane service four times weekly between Los Angeles and San Jose, P. R. via New Orleans on May 2. During the same week, Delta will also begin through plane service twice weekly between Los Angeles and Cancun via New Orleans and Managua (AW, January 20, p. 38).

► Continental Airlines reported 22,230 passenger loadings in February—a 95.6% increase over the same month last year.

► Flying Tiger Line reported a net loss of \$125,496 for the last six months of 1961. The airline attributes the loss to the high cost of placing its 10 Convair 440-1H turbopropellers into service. The airline expects to raise its annual net loss from \$70 million in 1961 to \$45 million this year.

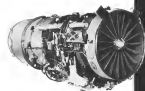
► Japan Air Lines has begun service between Tokyo and Europe with its aircraft, delivered since 1960-61 jet transport. The seven 10 aircraft will replace an earlier DC-8 which will be used on Japan Air Lines transpacific flights. The airline is scheduled to add two weekly flights on its Los Angeles-Honolulu-Tokyo route and a new weekly Honolulu-Tokyo flight.

► Northwest Airlines reported a net loss of \$517,156 during February. Operating revenues for February were \$9.1 million and expenses were \$10 million.

► Piedmont Airlines carried 45,190 passengers during March—a 21% increase over the same month last year.

► REA Express and Pan American will begin a low-cost joint aircraft freight service between the 45 scheduled cities and Hawaii on Apr. 19. Shippers will move via REA's Pacific routes to Los Angeles, Portland, San Francisco, and Seattle, and fly down to Honolulu by Pan American. Rates will be competitive with other carrier steep-subsidy rates.

► Trans-Texas Airways reported it carried 38,322 passengers during March, 15.9% increase over the same month last year.



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Rolls-Royce turbine engines fly more than 15,000 hours every day in airline service; their operating experience now totals more than twenty million engine hours. These engines have been chosen by more than 100 airlines and over 300 other civil operators. They power over half of the turbine airplanes in service or on order in the western world and hold world record times between overhauls (overhaul times) for all three types of turbine engine—prop-jets, turbojets and by-pass jets.

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AERONAUTICAL ENGINEERING

Supersonic Transport Simulator Tested

By William S. Reed

Wallops Field, Calif.—Aeronautics activities and control characteristics in flight in most supersonic transport designs make consideration of such performance quality factors, such as stability, controllability, and maneuverability, probably will be needed throughout all flight regimes.

Preliminary results of piloted wind-tunnel studies here at the National Aeronautics and Space Administration's Ames Research Center reveal that the supersonic transport probably will be marginally controllable by the pilot without artificial stability, or extreme speeds in good weather. Such conditions would not be acceptable for safety reasons, however, and other design improvements must be made to provide satisfactory handling qualities in operation with one or more aids of stability augmentation working at all times must be accepted.

If the latter choice is chosen, it would avoid excessive penalties in performance, stemming from design compromises but not representative of what is forthcoming in the stability of stability augmentation systems (SAS). Reliability of the one-aid SAS—now dispenser—on today's jet transports falls far below that required for a fail-safe no-go system. These conditions were reflected by the Avionics Work pilot during extensive "fling" in the exper-

iment transport simulator at Ames and from thorough discussion of the results for engine-out, in-flight conditions. M. B. White, M. S. Sedell, and R. S. Barr, with engineering test pilot C. F. Cooper, Chief of Operations at NASA Ames.

To date, with a handful of pilots have had the opportunity to fly the supersonic transport simulator at Ames mainly because the simulator has not yet been brought to the prescribed state of development. Within a short time, Ames' researchers will seek to have an engine pilot at possible speed some time in the simulator in order to have them operate to be integrated into handling quality requirements. Specifically, flight will be pilots with extensive experience in supersonic aircraft and large aircraft, including, where possible, military pilots and experimental test pilots.

Simulator Program

Under consideration in the simulator program is a typical supersonic transport design consisting of a low aspect ratio delta wing carrying four delta-winged engines. A raised, curved surface in rear for longitudinal control. Variable geometry wing planforms also are considered. Static and dynamic stability derivatives for this configuration were obtained in a wind tunnel test of typical delta-winged models.

Two simulators are in use at Ames

for supersonic transport handling quality investigations.

• **Control.** Pilot stability and control qualities are simulated dynamically in a machine having four degrees of freedom, roll, yaw, pitch and lateral acceleration. A cockpit is mounted on a cart weighing over 10 lb. in length. Three angular degrees of freedom are provided—roll, pitch and yaw—by gimbal mounting the cockpit carriage. Linear acceleration is provided by moving the simulator around the track. Roll, pitch, and yaw, in a second degree of freedom, in the vertical axis of the cart, is provided by the cockpit vehicle.

• **Approach and landing simulation.** Consisting of a stationary cockpit with flight controls, by actuating actuators and a closed-circuit television display projected onto a screen located ahead of the cockpit.

Great care is exercised in specifying the engine simulator. Structure of abrupt power loss as an outboard engine produces lateral accelerations of up to 1g and can produce various effects after a stall.

The cockpit in the engine simulator reaction time or less simulated maneuverability with the inclusion of a Mach meter and speedometer. Two throttles are used which control the fuel/air mixture which are the most critical. For acceleration, a control stick is installed where the wheel. Stick buttons are used to stop the reaction of the need area.

The problem is stated with the machine in a trimmed condition for flight at 70,000 ft, Mach 1 and indicated speed of 497 ft. Stability of the aircraft model can be varied by the adjustment of parameters at the engine computer with an actuator corresponding to "disrupt off" operation.

Prior to closing the hood on the simulator cockpit, lip and shoulder harness are snug fastened, a restraining strap is buckled around the chest and a crash helmet is donned. This approach encompasses procedure later was initiated when simulated engine failure produced the aforementioned by role restrictions. The machine is capable of maximum airspeed of 2.5 mi/sec, maximum angular acceleration of 2.5 rad/sec and maximum lateral acceleration of 1g.

Engine cuts at maximum speed seem to be one of the most critical maneuvers which occur in the simulation about the supersonic transport. Not only is the loss of an engine pro-



CRUISING FLIGHT SIMULATOR provides three angular degrees of freedom—roll, pitch and yaw—and four degrees of freedom by moving the cart around the track for lateral acceleration and vertically for pitching acceleration. Area on the carting, a 10 lb. roll and lateral accelerations of up to 1g are provided to simulate sudden failure of an outboard engine.

ing moment due to loss of thrust but explosion of the shock wave within the engine inlet adds a further moment which about divides the total yawing moment. Simulation of the yawing moment by lateral acceleration automatically reproduces the effect felt in the sides of a large supersonic transport where the pilot can be located 10 ft ahead of the center of gravity.

For the purpose of the problem, a degree of yaw at cruising speed was considered to be the structural limit. With SAS on, it was not difficult to keep the yaw within limits but separating a one-way rate after engine cut without the benefit of the SAS was very difficult. Yaw limits which would have meant structural failure were exceeded nearly every time.

It was during these yawing maneuvers that the instability of flying the simulator before a stall became apparent.

After the initial lateral structure, a constant altitude must be maintained by the simulator carriage in order that the pilot does not experience an apparent acceleration as he would if the carriage stopped. This results in shifting around the track, at a moderate rate with atmospheric stall acceleration, which physically is discomforting. This too, aside the yaw rate is noted, the simulator is moving with constant velocity and the stall rate is noted indicate to the pilot that he is

under steady-state flight conditions, the movement of the carriage wheels into the tracks can be felt causing one sense to believe the other.

Normal maneuvers with all engines running are easily performed with the SAS operating. The high indicated speed needed in very slow turning maneuvers is adequate bank angles. Also, slight changes in longitudinal trim resulted in large changes in altitude making it difficult to hold altitude. Effect of induced drag resulted in noticeable changes in speed in the steady banking and slight maneuvering maneuvers were required.

With the SAS turned off, handling qualities became much more complex in the directional area. Flares of one run into the stall one pressure, one it was not unusual to find that all three axes of the SAS would fail simultaneously.

In general, the opinion prevails among pilots who have tried the simulator that it would be undesirable to maintain the flight at one or more axes of the SAS failed. Level of damping in the yaw, roll and pitch axes would have to be increased to a much higher value than that possessed by the aircraft themselves. Consideration could be given to accepting some performance degradation to achieve better actuator values and maintain the nature of the motion indicate to the pilot that he is

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under steady-state flight conditions, the movement of the carriage wheels into the tracks can be felt causing one sense to believe the other.



CLOSE-UP COCKPIT TELEVISION PICTURE of a model moving away is projected onto a screen from the projector mounted on end of a stationary cart. Image from a C-134. Considerable motion is obtained by this method at considerable distances with 200 ft. as its stability.



1. Simulated cockpit controls. Working Area, with 100 control displays



2. Display chosen open



3. Main display open. Remote control operating when holding as load or when permit safe exit

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C113) with boundary layer control. Ahead of the subsonic cockpit is a seven seats which a closed control information picture is projected. A Delta visual simulator which uses a model runway and a nose down camera provide the stage for perception of a scenario as it would appear when emerging from a 200 ft ceiling with one-half mile visibility. The simulator can be flown down to touchdown which is depicted by a rapid hill through the nose. It can even be guided along the runway with the rudder down to demonstrate rudder effectiveness speed.

Conventional cockpit instrumentation is provided with a three axis gyro horizon integrated with motion derivative needles. A small index to the left of the gyro can act as a shock indicator which is helpful when trying to maintain a precise attitude.

Experiments that was gained in the simulator by firing the topmost subsonic jet transport. A Phased oscillator, also typical of the simulated transport, was evidenced by a long-term long period oscillation. Some level/altitude control oscillation, Dutch roll, was evident and while the handling qualities of the simulated aircraft left much to be desired, it was typical of the actual drive hardware. No airframe effect was simulated at this normal off-pair loading.

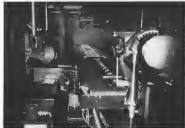
Loading Attempt

The problem is started 7 mi. from touchdown at an altitude of 1,500 ft on the centerline of the runway. Near mid ILS position, it was with the ILS information either presented on a separate ID 244 instrument or as the Flight Director superimposed on the gyro horizon. The latter presentation was preferred precisely when the Flight Director needles were moved to act as a "Zero Reader."

At the commencement of the glide slope, power was reduced and an air speed of 140 kt was held with a decelerate rate of 750 ft/m. Stroke light on the approach began to emerge when the aircraft reached about 270 ft and the runway threshold appeared on the screen at 200 ft and 1 mi.

Some practice was required to make stabilizer touchdowns because of a lack of presentation for peripheral vision. Though not here prone to extending the display so that it covers about 60% of the pilot's forward vision rather than the percent 10%. It appears that peripheral vision is very important in judging height above the runway. Misleading, misleading and erroneous can be simulated.

After sufficient practice with a known configuration, a programmed tape is fed into the computer which changes the characteristics to insure drive the actual hypersonic transport. Two in-



4. DALTO VISUAL SIMULATOR is used as model for closed cockpit information presentation. Runway model has threshold lights, boundary lights and stroke bar approach lights on a moving belt. Camera is long-focused to simulate no-visual control within a repetitive roll, yaw and pitch changes. Shot marks are superimposed on the runway adding to realism.

speeds are chosen to integrate tape about one or near the "back side" of the power curve.

At 160 kt, the power required to maintain level flight or a constant rate of descent varies little with small changes in speed. At 147 kt, considerable power must be added to maintain constant altitude rate. If speed is reduced to 140 kt, power must be added to maintain the task rate.

Most commercial aircraft do not operate on the back side of the power curve though this has been done successfully by the military. Cautions by delay in landing in this condition, however, as the sudden onset of high air rates due to unusual high angle reductions is imposed on final approach.

Lateral directional derivatives were not varied in the loading simulator during flight but at some times, data will be exhibited in part of the visual display. Derivatives need were based on a model which provided sensitivity on control on the roll axis and somewhat sluggish action in the large reduced results. The simulated aircraft weighed 300,000 lb at takeoff and landing weight was 210,000 lb. It was again a delta wing with a small control surface area. Lifting characteristics of the aircraft were altered to produce variations in thrust, bottom and back rates of the power curve. Static margins were altered for the three runs chosen to provide values of 80, 45° and zero. In general, as the stability margin moved toward the negative, i.e., lower speed required more power, and the static margin decreased, the aircraft's behavior became handling qualities. Operating in the front side of the power

curve with a static margin of 8% made the simulator respond like a subsonic jet transport but that resulted from low speed design features which would have, without compensation, high speed performance. Most high, the response transport without WAS will handle unstable the simulator did with a low static margin on the back side of the power curve.

Pilot Work

It was of interest to note that if the engine director needles on the horizon gyro were switched so as to act as a nose pointer, static stability criteria became less important to the pilot. Reason seemed to be that less time was needed before detecting an off course and cranking in the proper amount of correction was automatically due to centering the needles. A great many more corrections were required to keep the needles centered and pilot effort was much more arduous but the results were better.

Most of the ILS approaches and landings performed by Voyager Work in the simulator would have been disastrous if attempted as it is actually under steady conditions of weather and handling qualities. Most generally, agreement with the aircraft was good and light runs would have been required to free up the last moment. Flaring stroke lights on the runway approach helped in determining alignment but at approach speed of 140 kt, no tactile information was left after visual contact was established.

Despite what appeared to be good roll rates and angle static stability, as the longitudinal mode, landing from 750 ft ceilings with a low stability became a delicate matter.



MATERIALS LABORATORY IN SPACE

A comprehensive understanding of the reaction of materials to outer space is an important key to this country's space progress. In their study of materials, scientists at Lockheed Missiles & Space Company found the problem could be most graphically depicted by showing the various environmental factors impinging on a single cube-shaped vehicle. A cube, placed in a near polar circular orbit, would allow unobstructed isolation of the effects of space on materials, make their measurement simpler and more accurate, and offer a built-in control of the results. For example: The horizontal surface facing away from the earth would receive only direct solar insolation, while that facing the earth would get mostly earth shine and earth-reflected solar radiation. This hypothetical model readily illustrates the effects of such phenomena as: Solar irradiation, sputtering, micro-meteoritic erosion, solar corpuscular radiation, auroral radiation and the like. Guided by engineers and scientists of outstanding calibre, Lockheed Missiles & Space Company has won its place in the forefront of many disciplines in missile and space technology. And each progress constantly creates key positions for others of proven ability. Lockheed's location in Sunnyvale and Palo Alto on the beautiful San Francisco Peninsula is ideal. So is the climate—physical and mental. If you are interested in correlating your specialty to one of Lockheed's many challenging assignments, please write to: Research & Development Staff, Dept. M-37A, 256 North Mathilda Avenue, Sunnyvale, California. An equal opportunity employer.

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tions) with standard crystal can relays. A wide variety of mountings and terminals are available. □ Which reminds us, Leach has a complete line of standard size subminiature crystal can relays, too. Yes, when it comes to relays, any way you look at it, you should

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T-38s Cut Pilot Combat Readiness Time

By Edwin J. Ballou

Randolph AFB, Tex.—Combat readiness of all USAF Air Training Command first class of undergraduates to complete basic training in the upcoming Northern T-38 Telen has doubled he markedly less than any previous class, ATC Commander Lt. Gen. James E. Briggs said here during graduation exercises for Class 62 FZ.

High performance characteristic of the T-38, which embodies many of the handling characteristics of modern tactical aircraft, including high sink rate, high climb rates, high altitude true air speed navigation and supermaneuvering, was flight will permit these students to upfly, simulate the individual class status of the aircraft in the tactical arena they will join. About half the class will go into F-100s and half into F-105s and therefore will be able to start earlier to learn weapon system delivery techniques and tactical operations.

Students began formal operations work within five hours after the start of training in the Telen.

Time lag that has been present in forwarding students with aerial, but not aerial and their weapon systems following assignment to units was pointed up by several officials here including Col. Charles E. Yeager, Deputy Director of Flight Test, Edwards AFB, who indicated that new time and money could be saved with use of an armed T-38 as an aircraft that could perform weapon system training on the undergraduate level.

"The T-38 would lead staff to such a program soon. Northrop already has developed a single-seat N-160 version of the airplane having tactical weapons delivery capability.

As a further indication of USAF interest in the Telen, in providing low-cost supermaneuvering, two General Dynamics B-53A Bomber planes will be the Telen for 10 and is also the in mid-level in the supermaneuvering program.

T-38 Phasing Out

Class 62 FZ provided several important aspects to USAF training and test program as the means of becoming the final class to be supermaneuvering before its numbers reach of their wings here last month.

New Air Training Command undergraduate program, including the T-37A (wing jet program) and the Northern T-38 for basic marks the beginning of phase-out of the Lockheed T-38A for the basic training mission.

For the first class, carrying the Z for

"test" designation, Air Training Command added 26 students from 62 FZ class from several schools, making an average group to get a full complement of the student-T-38 capabilities, since the airplane concurrently was finding its Category 3 test program which also into the airplane in a new basic. Class graduation also marked end of the Category 3 trials, although some product improvement and other tests will be made.

Quick conclusion is a proposal for modified and initial test aircraft will be made on the airplane against the new M-101 pop-up cable release burst tests.

Aircraft has been checked out against the standard sub-type normal burner. Some minor engineering is also being done to prevent in-flight engine failure, including simplification of the canopy thrust axis.

Class 62 FZ, along with other members of 62 FZ, also pointed up some possible differences from the Air Force standpoint in its work as a result of the new Air Force Undergraduate Pilot Training Program under which cadets maintain which were phase-out of the present training cycle last year.

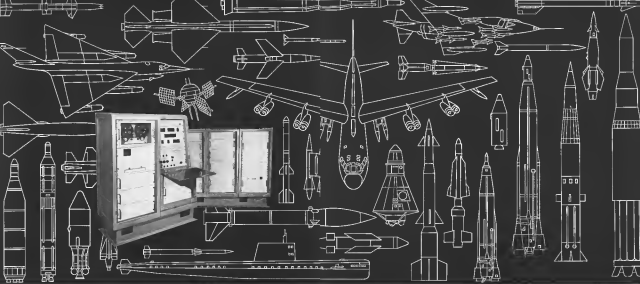
Air Training Command states that the new system, under which undergraduates take all their training at one base under a one-phase, uniform environment has paid off in better training since the supermaneuvering better control of the students and classes as expected, student instructor relationship. Foreman flying and low-level navigation are now introduced in the primary training phase, providing much easier transition for the student, according to ATC personnel here.

There is also much time saved since all the training is done on one field. Under the contract system the students went to an Air Force base to complete training. Students now are kept in the same squadron throughout the undergraduate course. Not only are time savings due to elimination of "paper" traveling expenses, but the fact that the student stays at the same field makes it easier when he gets to higher performance units because he already is familiar with topographical landmarks. Exposure to the basic trainer airplanes while he is undergoing primary training is also reduced with providing a more efficient environment.

Class 62 FZ went through 100-444



SUPERSONIC T-38s at Randolph AFB, Tex., undergo Category 3 testing concurrently with training of first USAF class in the new system.



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Consult your nearby IM representative for helpful technical details. Or write: Magnetic Products Division, Dept. MCH-42, IM Co., St. Paul, Minn.



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Magnetic Products Division 

First BAC 111 Fuselage Jig Built

Flite-Built Aircraft Corp. BAC III forward fuselage side panel (g) has been built at Vickers-Armstrongs plant at Here. Upper panel components VC10 type elliptical pylon wing windows, measuring 14 in x 9 in., between each of the fuselage frames. Ground service frames at 28 in pitch support Z-section struts to which also a floor ceiling with 70 deg. cut corner ribs attach. Truss and stringers are continuous and riveted in the skin. A construction line used on the Vickers Viscount Vanguard and VC10. Windows have Rodacel stiffening patch surrounding the aperture.

of training at Randolph, divided into three categories—Eight training and one doing taking 140 hr each. Officers from our subjects totaled 190 hr.

Tennison being a total of 38.5 hr., marked the largest portion of the flight training schedule. Instrument flying totaled 51.5 hr., navigation 27.25 hr., and W 38 ground instrument trainer 37 hr. Flight instruments totaled 21 hr. The course included 10 hr. solo in the T 38, with the average student time to solo being 24.5 hr. Missouri time for a Cessna 441Q2 student to solo was 12.70 hr.

The crane was 10 ft longer than used for the T-15A, but this was planned as the conservative side and to provide additional function and structural training.

Waive-out rate of students was low—62.4%, graduated 35 out of the 26 students who started on the T-35 and, in, class completed the course, without a single accident. Student waiver-out rate has gone down markedly from approximately a year ago. ATC officers noted—from approximately 35-40% to about 35% on the average. The decline is also noted as a benefit of reviving the training system to an all-Air Force operation at this base.

The T-38 has a more efficient entry point and control presentation than even the T-35A—which was selected

for training is contrast to the T-19, which was specifically designed for the job from the start. T-19's high rate of climb—over 72,000 fpm—is a distinct training aid in allowing "working" altitude and providing more training time than slower climbing airplanes.

Although it is most commonly applied than the TSTA, the TFS has proved to be a major problem on the line and the various forms of maintenance per flight hour are being projected at approximately 14 to 16 against 10 for the Lockheed, which has been in service for approximately a decade. "Bellini," pointing out component replacement concepts are widely used in the new, is planning to select those-time critical items for single-point high-pressure retooling and a liquid nitrogen station requiring only one filling tank, which reduces turn-around time.

With the production of Class 62-87, the weekday trains program entering the T-15 AFB is building up at VTC's main training base, which is getting taken to space since T-15 is starting with Webb AFB Big Springs TX. The approximately 40 airplanes used in the first class will remain at Randolph AFB for use in contractor training programs. Webb AFB is scheduled to have its T-15 component in June. Production rate on the T-15 now is approximately 12 aircraft monthly.



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blade chip detectors are also widely used in jet and reciprocating engine applications, etc.

Write for Catalog and application data





First two aircraft are under construction at Short Brothers & Harland, Ltd., shop in Belfast, Ireland. All fuselage sections later built are used on the first airplane, above right. Aircraft is 139 ft long, powered by two Rolls-Royce Type 611, 12 megawatts.



Forward cargo door, above left, is hoisted up past side, just forward of wing loading edge. Hold volume is more than 11,000 cu. ft. Cargo hold, above right, can carry up to 100,000 lb. at height is 56,800 ft and 140 passengers.



First RAF Short Belfast Turboprop Freighters Reach Advanced Construction Stage in Ireland



Above left, workers install nose housing on first aircraft for cargo and other access gear. Nose fuselage is previously, when nose section is installed after outer nose is mated to fuselage, above right. Third nose section is in background.



Belfast fuselage sections are built in level assembly pits; below, RAF has ordered 30 planes with first flight set for early 1963.

PRODUCTION BRIEFING

Chrysler Vought Aerospace Division will provide blackboard and ground-support equipment for a new Scout research rocket launch facility at Pinalia Missile Range, Ft. Angeles, Calif., under a \$1.6-million NASA contract.

Rohco Electronics Corp.'s BAP-5 all solid state receiver for target detection has completed final months of testing at the U. S. Navy's Missile Test Range, Ft. Meigs, Calif.

Northrop Corp.'s Ventura, Calif. division will produce KD2W-5 radio-controlled aerial target drones for the Navy under a \$1.5-million contract.

General Construction Co., Inc., Pensacola, Fla., will build a research and development facility for the Army Ordnance Missile Command at Redstone Arsenal, Ala., under a \$4-million contract. The new building, first step in program of related in-house capability of R&D laboratories, will house three new labs and part of a branch. Completion is scheduled for September, 1983.

United Aircraft Corp.'s Hamilton Standard Division has completed a successful 10-day continuous test of a sensor for measuring waste gas in turbine breath from a jet engine's gas turbine. The sensor traps carbon dioxide in adsorbent anion pellets and expels the waste CO₂.

Atlantic Research Corp. has been awarded a \$700,000 contract from Jet Propulsion Laboratory to develop a 17-in. solid propellant spherical motor and to study a 30-in. motor. Contract is under JPL's advanced development program, with an application announced.

United Control Corp., Redwood, Wash., will supply computerized navigation and control units for Minuteman ICBM guidance and control sensors under a \$108,880 Boeing Co. contract. The units will be used during missile flight in underground launch silos.

Stewart-Smith, Inc., Gardena, Calif., will provide jet power augmentation units and spare parts for India's U.S. built Panavia 3500 Fighting Bombers under a \$1.25-million contract from the Indian government.

Douglas Aircraft Co. has awarded Victor Products Co. to develop manufacturing and market products employing dual diatomic propellant and low temperature engine to meet, thus, a down-south products from Hughes Mail Co., South Miami, Calif. New facilities for Victor, adjoining Douglas' plant in Long Beach, Calif., will be completed in May.

Ryan Aeronautical Co., San Diego, Calif., has received follow-on orders totaling \$4.75 million for augmentation and ground support equipment and spares for Navy J-40C Phantom jet target missiles.

AeroSpace Division of Walter Kells & Co., Inc., will provide nonpropellant provide various control surfaces for the Project Stratos communications satellite under contract to Hughes Aircraft Co. The system, which will be operational for the life of the satellite, employs nitrogen gas to pressurize liquid hydrogen which in turn is cathodically decomposed and expanded through a nozzle to produce required thrust.

Ansel Propulsion, Inc., has been established as a fifth operating domestic division of Celanese Corp. of America and has been awarded Ansel Propulsion Co. Ansel, formerly a subsidiary, develops and manufactures explosive devices, propellants and propulsion systems.



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AMERICAN AIR FORCE AND NAVY PHOTOGRAPHY
AIR FORCE AND NAVY PHOTOGRAPHY



Two naval rotor helicopter designs of Nikolai Kamov are the Hog (left), and Harp (right). Harp is designed for anti-submarine warfare with large white radome housing search radar in chin installation. Movable turret with two 37 mm. cannons is mounted above the rotor. Pair of air-to-surface missiles are mounted on each landing gear strut. Harp is larger than the earlier-designed Hog which was built primarily for crop dusting and civil transport.

New Soviet Aircraft, Helicopter Details Revealed



New gas turbine-powered version of the basic Mi-4 helicopter design has NATO codename Hup (left). Finselage is larger than Mi-4 and provides capacity for 24 passengers. Also note additional fuel tanks added in lower fuselage bulges. Arrowhead wing planform of the Pavel Sukhoi Fitter design (right) is revealed in these photos taken from underneath formation of these 1,300-mph. fighters. Wing plan is basic delta with tips extended, a design Soviets favor for combining efficient subsonic cruise with top supersonic performance.



Another view of Fitter formation (right) shows large nose air intake for single 22,000 lb. thrust axial flow turbojet. Note horizontal tails. First published photograph of new Beriev turboprop-powered flying boat is shown at left. Aircraft is NATO codename Moil. Gull wing with high aspect ratio is typical of earlier Beriev designs. Two turboprop powerplants are estimated to produce 5,600 each. Note wingtip floats, nose-mounted radar and magnetic detection gear protruding in tail stinger.

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Martin Ejectijet ground effect machine, shown in orbit's concept, would travel forward at approximately 20 mph, while about a foot off the ground. Air cushion is recirculated.

Martin Ejectijet Recirculates Air Cushion to Ease Engine Load

Oakdale, Fla.—Martin Ejectijet, a ground-effect machine, may provide some of the air cushion, a soaring roll-out and shutdown flights at Martin Marietta Corp.'s Aerospace Division here.

The new coming turboprop grew out of a feasibility contract awarded by U.S. Army's Transportation Research Command (TRICOM) during its January 1981 and carrying a delivery date for prototype of April 75.

Three ideas behind the Ejectijet concept: the incorporation of an under the vehicle. This is in contrast to other GFM designs which generate a cushion of air beneath the vehicle and allow it to rise, subside and/or rise from the base. This means that the full amount of air necessary to form the cushion be continuously generated at all times by the propellers. In the Martin GFM, water of the air is recirculated and only about 35 lbs. take new air in. Thus, even the initial air cushion has been established, the propellers need only breathe approximately 5% of the total air flow as making air.

The design uses the principle of the rectangular vehicle as a shield to direct and recirculate the recirculated air. In construction, this shield shows as a rounded ellipse. As water the shield through an engine nozzle at the shield lower portion, water up and outward through the shield, and recirculating flow is at points along. It leaves

the outer rim of the cylinder shield with downward and inward components of velocity, so that its natural tendency is to flow from the outside of the cylinder toward the center.

The cylinder's outer section creates a low-pressure area upstream of the jet exit point, which traps the moving air and entrains it to go through the hole again. No side curtains are used to contain the flow, and there is no overboard loss.

Martin engineers believe the Ejectijet will show much higher overall efficiency—perhaps as high as 60%—and that both stability and control will be greatly improved because of the semi-cylindrical generic Model tests, which were performed under the first phase of the TRICOM contract, showed good promise for the principle the validation of these tests is one major aim of the full-scale vehicle work.

The main concern Ejectijet will be used to establish basic performance data for the type and to evaluate static stability and control efficiency. As a test bed, its performance is limited, it will have at about one foot height, Martin predicts, and will be able to make about 20 mph over terrain.

The vehicle is on the order of 12 ft wide and 20 ft long. The planform is rectangular. Propellers are at unspecified number of Adaircraft gas turbine engines, furnished by the Aero to Martin for the testbed.



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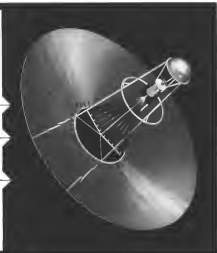
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SPACE TECHNOLOGY



MODELS of 21-man space station, or space laboratory, being designed by National Aeronautics and Space Administration in North American's Space & Information Systems Division, are shown in launch's independent orbit and in fully-assembled, integrated wheel shape (right). NASA may attempt to put station in 180 mi. earth orbit in 1966. Assemblies will be able to transfer from Apollo spacecraft into the station through hatches in the command module, shown at hub of wheel. Hubs will have same Apollo docking ports.

1966 Orbit Planned for 21-Man Station

Los Angeles—National Aeronautics and Space Administration's 21-man self-carrying space station may be placed in a 100 mi. earth orbit as early as 1966, it was reported here recently at a local meeting of the Institute of Radio Engineers.

North American Aviation's Space and Information Systems Division has been studying the hexagonal-shaped station

(AW-50, p. 27) for the past few months under a contract (probably a cost-sharing one) from NASA, awarded to Los M. Tinsley, principal consultant with the company's Mission Space Systems Group. A booster, probably a Saturn C-1 or a Titan II, is already staged to orbit a manned space station originating from the design being worked out by North American.

The station will be designed to operate in space for a period of one to two years.

As it is now envisioned, the station will consist of six cylindrical modules, each about 75 ft. long and 10 ft. in diameter, which will orbit on command in space into a stacked wheel.

A manned command capsule, located at the hub of the wheel, will be connected via three 50-foot-diameter sun-screen telescopic spines to the end-points of alternate rim modules. Once the station orbits in space, the crew can pass from the command capsule through

the spines and into the rim modules.

The station will provide about 2,000 to 3,000 cu. ft. of space for each crew man, slightly more volume than is available in the average U. S. home for each member of a typical family. Crew will stand in the rim modules with their heads pointed toward the hub which faces the sun.

In the launch mode, the six rim modules are lashed together with their long axis parallel and the handle placed into a launch. Alternate top and bottom of the modules are hinged to one another. A rotating mechanism is released in space permitting the rim modules to unstack and, spring into a hexagonal wheel-shaped mesh like a basketball fishing bridge table, which has spring-mounted legs.

In the dock and orbit position, the command capsule is attached atop the handle with the wheel's telescopic spines pointed downward into the rim module handle. The diameter of the rim module handle will not exceed the handle diameter.

The present space station design which North American claims to be in late point configuration, is an outgrowth of several tries to combine the best features of two space station approaches—inflexible structures and structures composed of rigid members

internally. Initially, the company considered an inflexible structure, the skin of which would be as thin as that of a beach ball. This inflexible structure can be conveniently put into a package package but would require this sophisticated equipment to be installed after erection in space. In addition, an inflexible structure would be subject to damage or penetration by such events.

While the rigid structure approach is a measure, these shortcomings of an inflexible structure, it requires a great number of devices to a suitable launch package.

One design leading up to the first point configuration consisted of an rigid rim core interconnected by inflexible sections and connected from the hub to the rim by inflexible spines attached by alternate rim points. This design is now all discarded. It was too late in the late point configuration. Its 150 ft. the wheel would rotate, fixed the hub in space at 2 to 3 rpm and exposures as much of one growth force at the rim. An actual working model of the inflexible design was built by North American.

Since all areas will require electrical power, three large solar panels will be attached to the network, separate of each module, and comprise with the wheel's plane of rotation.

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UNIVERSAL TECHNICAL SERVICE CO., DIVISION OF SPERRY RAND CORPORATION, WICHITA, KANSAS

Cooling, Power System Proposed for Apollo

Denver, Colo.—Integrated engine cooling system and accessory power and operating at a maximum temperature of 1300° F. being proposed as a backup development for two separate systems aboard the Apollo spacecraft. Systems have been demonstrated by Sandstrom Corp.'s Avionics Division.

The system is named Conthecycle and Sandstrom officials believe it also has a good chance of being selected for Dyna-Soar 2, operational version of the space glider. Conthecycle uses hydrogen stored as an 80% liquid slush to reduce its volume factor, that of liquid hydrogen. The hydrogen is passed through heat exchangers to absorb the heat generated by the spacecraft within and the metabolic heat of its crew.

Apart from these sources evaporators and processors the hydrogen and the cold gas is used to drive a turbine of recuperating motor which in turn drives an alternator to provide electrical power. Apollo proposal is to use a recuperating motor.

Sandstrom officials claim the Conthecycle would be especially suited on the lunar surface, where daytime surface temperatures as high as 250° F. may reduce the efficiency of the selected Apollo thermal control system which has outside radiation to dump heat into space.

Apollo accessory power units and thermal management systems are both to be located in the service module. Sandstrom is stating that the Apollo service module is designed to have room for the Conthecycle and which is somewhat larger than the equipment it would replace. If the backup proposal is to be accepted, NASA must act by June 1.

Venus Atmosphere

Moscow—New 177.6-m. solar telescope at the Crimean Astrophysical Observatory, by means of a special spectrograph has observed molecular oxygen in the upper layers of the atmosphere of Venus, according to the Soviet news agency Tass. The recent report stemmed from observations made a year ago when Venus was nearest the earth.

U.S. observers had the report in wild because of the all-around clouds. The Soviet conclusion was made on the basis of a slight absorption of solar light collection of oxygen. "Now, densest in the atmosphere of Venus has long been known to be carbon dioxide and there is no indication Tass said, that nitrogen also is present."



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Space Committeemen Face New Problems

By George C. Wilson

Washington—Rep. Olin E. Teague (D-Tex.) dug through a mountain of mail as his desk and three down an editorial which he said exemplified the national spirit of choosing one of the two new House science and astronautics subcommittees.

The editorial suggested in the strong est sense that the people in his district primarily and the nation generally would be far better off if "Teague" Teague spent more time on problems in his own state than those in space.

Yet in chairman of the Manned Space Flight Subcommittee, he must be in the House floor a few days and he is providing his colleagues in the National Aeronautics and Space Administration spend some \$5.5 billion in the coming fiscal year in everything from Florida to Nevada to Alaska to Hawaii to Alaska.

How well he and other congressional leaders meet the political challenges to the NASA budget will have a lot to do with how much the U.S. spends on space. Before the Space Committee Chairman George P. Miller (D-Calif.), who succeeded the late Rep. Dorian Bland (D-La.), first sat, acrossed the House space committee he looking at who sponsored such and comparing their numbers to do everything possible to educate themselves. Some glaring deficiencies in Congress' ability to put on earth billion dollar space programs show up in the process.

Crew Cases

"I had no background for this job" and Rep. Teague. "I studied until I was sick and I was sick on the committee is a scientist. One I just had to look to anyone reading off books and get help when I could—NASA, the Air Force, industry—everything I thought I could learn something."

He did not his subcommittee, to place his Cape Canaveral to get further background, through inquiries and on-the-spot inspections. For example, the subcommittee held closed hearings of Cape Canaveral in an attempt to learn what was behind the Air Force-NASA dispute on the Atlantic Missile Range (AWR Apr. 9, p. 31).

The effect three subcommittees worked much the same way on the NASA Fiscal 1965 budget. All told there have been two full committee hearings and more than 40 subcommittee hearings since the House space committee began consideration of the NASA budget Feb. 21. Approximately 127 witnesses appeared and more than 7,000 manuscript pages of testimony were re-

ceived. The printed hearings will be added to the printed testimony of Congress since they represent the most detailed explanation to date of the national space effort President Kennedy ordered May 25, 1961.

Despite these hearings and house work, most House space committee members feel space about representing the opportunities of so much money in NASA. That increases their pressure from the space element in which they have been suddenly released. They have found during the space hearings that conventional methods of obtaining a clear picture is a probing conversation of witnesses followed by a series of questions and answers. They have found that the traditional methods of tracking testimony, the old way of keeping NASA's progress, the way of keeping the progress and first lack of technical knowledge. These space leaders are so far from giving NASA a blank check.

Prospective Dropped

"In all in line of accelerating the space progress as fast as it is logistically possible to do" and Chairman Joseph E. Keith (D-Miss.) of the Space Science Subcommittee "that I don't want to make us represent about the pro-

gram that I would like to see critical areas where investigations should be made. This attitude, he said, led the subcommittee to recommend that the \$10.4 million requested for Fiscal 1967 for the manned program, among other things, be dropped from the NASA budget. Rep. Keith said he the last few weeks is ready to let NASA's activities be funded in the U.S. will be close to putting a man on the moon. Also he said that he thought the manned program was not the most important. Several or announced last night a bill has gathered the same type of information. Survivors in stated to make a soft heart landing in 1967.

The attitude cutting a technique have followed by most of the subcommittee in sharp contrast to the actions of the full House Science and Astronautics Committee which usually act as a whole last year. At that time the committee, under Rep. Bland, had to give the program what he called "a sense of urgency" by authorizing more money than NASA requested.

This year's timetable has expanded in cutting the \$5.5 billion mark the start of the new treatment space budgets will come from Congress from now on, leaving a national emergency. No longer will NASA's budget run through Congress relatively unchanged but in the process of doing of the last subcommittee chairman this new treatment cannot be fully implemented until Chairman Miller agrees to have additional staff provided in science and engineering. Right now the right man space staff consists of four lieutenants from personnel, a communications specialist and an Area chief, each with a staff. Of the eight only Col. Earl C. Kirtland (D-Miss.) has had communications training and experience in space engineering and on space. He is on loan to the committee Subcommittee. Chairman Teague, Keith and Vickers, Andrews (D-N.Y.) continued overseeing space spending in different ways analyzing the military budget because the space program since full House action. Congress practically is now in a state of confusion. The backlog of knowledge to draw upon which the House and Senate around various committees even in a result of long exposure to the subject. This dilemma, the chairman agree, is caused by the dependence on their staff. Only Chairman Keith (D-Miss.) of the Application and Tracking and Data Acquisition Subcommittee, is aware of what his staff is capable of. He is the House space committee's high ranking Republican witnesses of the committee agree with the majority view.

Rep. James G. Fulton (D-Ill.) set

Committee Members

House Science and Astronautics Committee subcommittees, with the chairmen listed first:

• **Manned Space Flight.** Democratic Rep. Olin E. Teague (Tex.). Leslie G. Dickinson (Ga.). Thomas G. Allen (N.M.). William F. Row (N.Y.). Republican Rep. James G. Fulton (Ill.). E. Walter Ralston (N.Y.). Richard E. Rostenberg (Tex.).

• **Astronaut Research and Training.** Democratic Rep. Victor E. Atiles (N.Y.). William H. Madden (Ill.). David S. King (Calif.). James G. Thompson (Calif.). Republican Rep. J. Edgar Cornsforth (Calif.). Charles A. Mathis (Calif.). Anthony R. Hall (Calif.).

• **Space Science.** Democratic Rep. Joseph E. Keith (Miss.). John C. Carr (Tex.). William J. Randall (Miss.). Thomas N. Downing (Wash.). Republican Rep. E. William Van Fleet (Wash.). Parker Ross (N.H.).

• **Application and Tracking and Data Acquisition.** Democratic Rep. Ken Hinkle (W.Va.). J. Edward Roth (Ind.). John W. Dan (Calif.). J. D. Weyman (Calif.). Republican Rep. James M. Wright (N.C.). Thomas M. Pelt (Wash.).



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and ranking Republicans, and five persons with scientific backgrounds should be added to the staff. "We have to have people who understand these subjects and who go and see the facilities, who know Casavari, who know Houston. Then this one keeps us current."

Sensibly, Rep. J. Walter Ruckelshaus (R-N.Y.) said "our committee has been lacking in a staff that is qualified to follow thoroughly these programs and be of assistance to members in evaluating them." He stressed that he had no criticism of the present staff—it just needs scientific help.

The staff question gets the three subcommittee chairmen agitated. Chairman Miller who feels the chairman should be management oriented with scientific experience rather than professional scientists and engineers "who know all about gas. And such details." He said his committee is so short of office space that he does not plan to add more than three persons to the committee staff this year.

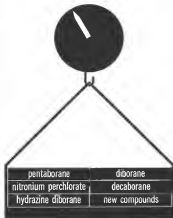
The difference between the subcommittee chairmen and Rep. Miller on staffing certainly is not major enough to wreck committee harmony. But it does underline two basically different approaches to congressional review of the U.S. space program. The Miller approach—the more governmental one—is the technique employed by the House Armed Services Committee when Rep. Miller served for some years. The other approach—more specialized—represents the way many members of Congress hope to satisfy their constituents and constituents that the space bill does not squander money. Significantly, the age difference between Rep. Miller, 71, and the second ranking Democrat on the committee Rep. Vatta, 62 is 19 years.

Miller's Plans

For the immediate future, Chairman Miller intends to take his committee on extensive field trips to scientific institutions and then focus internal activity on such unbridled activities as the National Review of Standards.

Rep. Miller also emphasizes the "service" part of the House Science and Astronautics Committee. During the year, he gives the committee a special trip to look into such down-to-earth scientific developments as neonatal transportation and ice column vehicles.

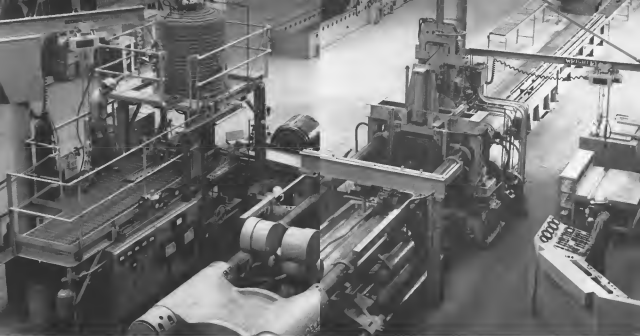
But what seems curious is because the most consuming interest of the House space committee is the national space program—if for no other reason than it can legally make overseeing a full time job. And the space-related branch of interest the committee is viewed in the program this year is reviewing the NASA budget. Indeed, the House, not the Senate, will become the most influential forum for the U.S. space program in the years ahead.



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New Scout Launcher Cuts Preparation Time in Half

New launcher for Long-Turn-Vought Scout aircraft rockets expected to cut preparation time in half has been delivered to Naval Air Station and Space Administration and is now being installed at Naval Air Station, Orlando, Fla. The new Scout launcher will be used by both NASA and USAF. Estimated time for Scout air gun undergoing Scout operations loading at Vought's Dallas plant and at NASA's Wallops Island, Va. facility, dropped by Chance Vought Aircraft Division under a contract for approximately \$180,000. The new equipment features an 81 ft. derrick-like structure that can lift a fully assembled 75 ft. Scout from the horizontal to the desired position. Other key components of the system include a 70 ft. variable and telescopic slide and a 12 ft. long telescopic, variable and rotating derrick. Launcher consists of a pivoting base, and the launcher structure is hinged to the base. Launcher with rocket installed, is capable of erecting 150 deg. in more of a 1 kg. section.



Close-up shows 1 kg. rocket (lower left), and grating for setting ETV launcher on its vertical axis for precise firing direction. At right is 20 kg. rocket, grating and inner legs and to slide or lower upper structure of Scout rocket launcher.





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U.S., USSR to Continue Space Discussions

By George Alexander

United Nations, N. Y.—United States scientists are cautiously but optimistically preparing to meet again soon with their Soviet counterparts for a second round of discussions on the possibilities of joint U.S.-USSR space activities.

American scientists led by National Aeronautics and Space Administration Deputy Administrator Dr. Hugh L. Dryden will gather with Soviet representatives led by Prof. Anatoli A. Bregmanov of the Soviet Academy of Sciences, either in Washington, D. C., later this month or in Geneva, Switzerland, next month. The meetings will be coincidental with either the Committee on Space Research (COSPAR) session in Washington, Apr. 10 through May 10 or the East European summit of the secretaries of the United Nations Conference on the Peaceful Uses of Outer Space in Geneva May 26.

First two meetings between U.S. and USSR scientists and diplomats were held recently in New York after President John F. Kennedy and Premier Nikita Khrushchev had exchanged letters calling for mutual cooperation in space activities (AW May 25, p. 27).

One U.S. source said that the Soviets in the first round "were not talking their usual cold-war line." He also indicated that the talks between U.S. and Soviet scientists led respectively by Dr. Dryden and Prof. Bregmanov, had been most fruitful thus far.

Between the two nations' deputy permanent representatives to the UN—James T. P. Flanagan of the U.S. and Tatiana D. Mitrova of the USSR.

U.S. and USSR areas in space research proposed by Kennedy and the so-called Khrushchev when a joint cooperative attempt could be made in both nations, it appears that U.S. and USSR specialists are considering a number of joint studies in each nation within the other's boundaries or parameters in joint intercontinental spaceflight or one nation or the other's territory, should the need be so great.

Key Instruments

Key instruments through which the U.S. and USSR have been attempting to reach an understanding in the exploration of space has been the United Nations Committee on the Peaceful Uses of Outer Space.

Created in late 1959 by the UN General Assembly, the committee had been all but frozen up for dead as the U.S. and USSR fought for nearly two years over the procedural rules to be followed in the committee's operation. The Soviets argued that proposed committee action be shaped by members of the committee's 34 nation members. The U.S. contended that this would be tantamount to veto power. The U.S.

preferred for rule by the majority, but the Soviets rejected this approach as an attempt by the U.S. and its allies to dominate the committee and against the objectives of the Western bloc on the USSR and its satellite nations.

The committee now increased to 78 members with the addition of Chad, Morocco, Mongolia and Sierra Leone, counts 13 nations against, expanded to pro-West, 5 in pro-East and 5 in neutral.

The committee met briefly for the first time last November and adopted its charter (Dr. Peter March, Vienna, at discussion). Prof. Mikail M. Bregmanov, Khrushchev's vice-chairman and Gen. G. deCastillo, Nikita Khrushchev's vice-chairman, were present. Upon receipt of the committee's report in this single meeting, the General Assembly passed a resolution which extended the mandate of the Committee on the Peaceful Uses of Outer Space, recommended basic principles for space exploration (AW Dec 18, p. 12), called for a general UN regime of all objects launched into space and requested the cooperation of the World Meteorological Organization (WMO) and the International Telecommunications Union (ITU). It also directed the committee to meet again on later than May 31, 1962.

U.S. and USSR exchanged details notes on cooperative procedures and the efforts implemented on consensus in the method of operation. It was then announced this agreement on May 19 as the committee recommended for its first

NASA Funding for Centaur Program

This chart shows the money the National Aeronautics and Space Administration has allocated for its Centaur program in Fiscal 1961 and Fiscal 1962, and its requests for Fiscal 1963.

| | World Development | Fiscal 1961 | Fiscal 1962 | Fiscal 1963 |
|---------------------------------|---------------------|---------------------|---------------------|---------------------|
| Second stage design engineering | \$2,100,000 | \$2,100,000 | \$2,100,000 | \$2,100,000 |
| First-stage production | 4,400,000 | 4,400,000 | 4,400,000 | 4,400,000 |
| Second-stage production | 14,474,000 | 14,474,000 | 14,474,000 | 14,474,000 |
| Ground testing | 8,400,000 | 8,400,000 | 8,400,000 | 8,400,000 |
| Launch support | | 9,474,000 | 10,700,000 | 10,700,000 |
| Total | \$37,374,000 | \$37,140,000 | \$37,140,000 | \$37,140,000 |
| Engine Development | | | | |
| Design, engineering | \$2,000,000 | \$2,000,000 | \$2,000,000 | \$2,000,000 |
| Fabrication | 7,444,000 | 7,444,000 | 7,444,000 | 7,444,000 |
| Ground testing | 10,333,000 | 10,333,000 | 10,333,000 | 10,333,000 |
| Total | \$19,777,000 | \$19,777,000 | \$19,777,000 | \$19,777,000 |
| System Support | | | | |
| NASA | \$1,100,000 | \$1,100,000 | \$1,100,000 | \$1,100,000 |
| AFSC | 1,000,000 | 1,000,000 | 1,000,000 | 1,000,000 |
| Marshall Space Flight Center | \$1,100,000 | \$1,100,000 | \$1,100,000 | \$1,100,000 |
| Propellants | 200,000 | 200,000 | 200,000 | 200,000 |
| Total | \$3,400,000 | \$3,400,000 | \$3,400,000 | \$3,400,000 |
| Total | \$60,551,000 | \$60,317,000 | \$60,317,000 | \$60,317,000 |



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ported working session, saying "I should like to place on record that through informal consultation it has been agreed among the members of the committee that it will be the use of all members of the committee and its subcommittees to conduct the committee's work in such a way that the committee will be able to reach agreement in its work without need for voting."

In effect the agreement states that the Soviets will lower the prevailing attitude of committee members as demonstrated by private conferences and, in turn, the U.S. will not push its public show-down.

Having found an area of agreement, the committee then invited the WMO, ITU (the United Nations Educational Scientific and Cultural Organization) (UNESCO) and the Committee on Space Research of the International Council of Scientific Unions to participate in the committee's work.

Subcommittees Formed

The committee then turned its attention at the end of its 10-day session to organization and created two subcommittees of the whole—the first Scientific and Technical and the second Legal. Both subcommittees were asked to meet at the same time during May and at the same place—Geneva—to permit exchange of viewpoints. The subcommittees were allowed to work out their own agenda when they meet although both the U.S. and USSR offered suggestions.

The committee agreed to meet again at the United Nations either in August or September this year to consider the reports of the subcommittees and to receive the reports requested of the

Gemini Recovery Tests

North American Aviation's Space and Information Systems Division will test parashut recovery system on a model of NASA's Gemini capsule, for which it is preparing.

Backup unit for the recovery system is an M-1000. Mercury capsule-type parashut system being developed by Northrup's Ventus Division for McDonnell Aircraft Corp. A special system set for use of the full abort of the Gemini spacecraft is being designed by McDonnell, but will be developed and qualified by a test manufacturer.

Gemini's test will be similar to the Deimos test to be held by Walter Aircraft Corp. for Boeing. Gemini will undergo more modifications and will fly back to allow attachment to go into a reentry position to spend the private time.

Half scale testing of the Gemini test is scheduled to begin in May of full scale test to be held in June with full-scale testing at ED Center GM.



Second Advent Antenna Erected

Nine-ton parabolic reflector antenna dish which will track Ad-Ad communication satellite is installed at Camp Roberts, Calif. A similar dish has been erected at Ft. Huachuca. The antenna, designed to track Ad-Ad on an EL-300 air vehicle orbit.

WMO and ITU by the previously mentioned General Assembly resolution.

The WMO specifically was asked by the UN to make a study of:

- State of the art advances required in technology to provide greater knowledge of the basic factors affecting distance and the possibility of weather modifications on a large scale.
- Development of current weather forecasting capabilities and the widening of assistance to UN member states through regional meteorological centers to make more effective use of forecast data.

The International Telecommunication Union was asked to make these aspects of space communications that would require international cooperation and to consider what UN member states would have to do in the development of their domestic communications facilities, so as to make effective use of communications satellites.

Most UN observers noted the committee's 10-day working session as constructive and a hopeful start toward greater international cooperation in space. The U.S., which has long contended that the Soviets do not double enough data in their space flights, found itself in the embarrassing position of providing low data to the U.S. space agency, the USSR. The U.S. took a liberal interpretation of the register's requirements and submitted data only on those satellites and space vehicles still in orbit. As a consequence, data on the flight of Lt. Col. John H. Glenn was not offered in the world information. Soviets who have never recognized an opportunity of maintaining Sputnik 1 or Cosmos 1 and Pinta's flight—or all three in their speeches before the UN, who wanted data on everything they have flown to date regardless of the fact that many of the satellites have long since fallen from orbit (see p. 97).

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Long Distance Weather Observations for greater forecasting accuracy are accomplished with Raytheon "Storm Radar" radar systems now operated by the U.S. Weather Bureau. The Storm Radar's 250-mile range and variable sensitivity permits meteorologists to penetrate the eye of a hurricane, locate rain, snow and clouds, or predict within minutes the arrival of a storm front at a given location.



Fire-Control Radars for Navy's Turbo Missile on the first of new guided missile destroyers, the Charles F. Adams, DDG-2, were developed and produced by Raytheon for the Navy's Bureau of Weapons. The radars, which help guide the Turbo missile despite enemy evasive tactics or jamming devices, are a part of the ship's overall fire-control system to direct the vessel's conventional guns.

Coast-to-Coast Control of fast, high-flying jet traffic is now possible with Raytheon "Flight Tracker" radar systems ordered by the Federal Aviation Agency for 51 locations as part of a nationwide radar network. Using greatly increased power and a "bright display" radar picture viewing screen, this system gives air traffic controllers a continuous flight path and history of all air traffic. The sequence tells where the planes are headed, where they came from and how fast they're moving.

Can RAYTHEON Electronics help you?



RENDEZVOUS ROUTE OR COLLISION COURSE?

A QUESTION OF SUPREMACY:

Pilots of U. S. Navy fighting planes will shortly be able to rendezvous or fly in formation with greater security under a wider range of conditions. For they'll know exactly how far they are from each other. ■ Air-to-air ranging will be added to their present TACAN sets with the General Dynamics/Electronics—Rochester SC-704 modification kit. No bigger than a "best seller" lighter than the circuits it replaces, it permits as many as 6 planes to judge their distances from a sixth, such as a group leader or air tanker. Conversion time? Negligible—only 3 fast hours. And the SC-704 actually improves the



GENERAL DYNAMICS

reliability of the air-to-ground function of the TACAN set because the vacuum tube modulator is replaced with a new, completely solid-state modulator. ■ Proficiency in air and missile-borne ranging equipment comes naturally to a division of General Dynamics, where the B-5B Hustler and Atlas ICBM were born and bred. General Dynamics/Electronics—Rochester is today's seed-bed of advanced ideas in the technology of navigational equipment and radar beacons. ■ Every product we make started with a question, like school boys. Write 1-900 North Gooden St., Rochester 1, New York

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Echo 2 Camera Capsule Recovery Technique Devised



Recovery technique developed by All American Engineering Co. will be used to retrieve a 36-inch camera capsule to photograph systems and inflation of a 115 ft. dia Echo 2 as a balloon test scheduled from the Atlantic Missile Range shortly. Greenham SA-16 of the Air Reserve Bureau 40th Squadron will drop two engines after the capsule has been ejected (ENR Jan. 3, p. 21) who will attach a 240 ft. length of nylon line to the capsule. A polyethylene balloon, inflated, will be attached to the end of the line and moved. Towing a buoy, the SA-16 will control the line and draw the capsule into the second. Major components of the All American system are the air datalogger recovery station, which houses the polyethylene balloon; line and balloon bottle (right). Polyethylene balloon (bottom right) is reported at the All American plant in Georgetown, Del.





Water Alcohol Check Valve



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Fuel Throttling Valve

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years experience, we can find it. You'll get a precise, reliable, long-life valve. The only kind we make. Write or phone 224-3841 today. UAP means United Aircraft Products. A dynamic, independent company in Dayton, Ohio. A name to remember when it comes to valves. Remember tomorrow for quality engines.



Soviets Reveal Data on USSR Space Vehicles

Soviet Union filed the following log of USSR earth satellites and other space vehicles with the United Nations Committee on Peaceful Uses of Outer Space. The log contains some corrected data, otherwise correct, on position, speed and attitude information the Soviets sent in a letter submitted to the United Nations with the data. Figures and space figures given by the Soviets in kilometers are followed by figures in parentheses which represent conversions to statute miles. Space vehicle 1 launched in October 1957, was the first successful launch of an artificial satellite from the earth. Because of track 1

launched by the Soviets in January, 1959 was to achieve means vehicle and attitude control satisfactory since, in April 1958, Vostok 1 carried Yuri Gagarin to space and orbited the first man to man had successfully been orbited, which, the earth's atmosphere.

Vostok 2 which was launched in August 1960, not carried in Gagarin. This was launched to check the effects on the human organism of prolonged flight in orbit, to make sure the earth's atmosphere, and tested such ability to function during prolonged periods of weightlessness.

| Designation No. | Name | Purpose | Date | Main characteristics of orbit according to corrected data | | |
|-----------------|-------------------------------|--|--------------|---|-----------------------------|-------------------|
| | | | | Perigee (km) (approx) (miles) | Apoee (km) (approx) (miles) | Inclination (deg) |
| 1 | First satellite (Soviet 1) | Study of the laws of motion of celestial bodies in the atmosphere | 4 Oct. 1957 | 217 (134,870) | 452 (280,900) | 43.3 |
| 2 | Second satellite (Soviet 2) | Study of the physical processes in the upper part of the atmosphere | 3 Nov. 1957 | 122 (75,800) | 1471 (913,300) | 47.2 |
| 3 | Third satellite (Soviet 3) | Research in the upper atmosphere with a radio probe | 13 May 1958 | 124 (76,400) | 1461 (908,000) | 47.2 |
| 4 | First space probe (Soviet 4) | Attainment of space vehicle and capabilities of interplanetary space | 2 Jan. 1959 | | | |
| 5 | Second space probe (Soviet 5) | Operation on the Moon, delivery of a payload to the surface of the Moon, and return during flight to the Earth | 12 Jan. 1959 | | | |
| 6 | Third space probe (Soviet 6) | Early on a circumlunar mission and return to Earth, carrying a payload to the surface of the Moon, and return during flight to the Earth | 4 Mar. 1959 | 20,000 (12,400) | 200,000 (124,000) | 47.2 |
| 7 | First space ship (Soviet 7) | Investigation and study of the main systems of the space ship, which means the ship and return to Earth, and the ship and return to Earth | 12 May 1960 | 217 (134,870) | 452 (280,900) | 43.3 |
| 8 | Second space ship (Soviet 8) | Development of a space station with the function and ability to fly in orbit around the Earth | 10 Aug. 1960 | 200 (124,000) | 200 (124,000) | 47.2 |
| 9 | Third space ship (Soviet 9) | Medical and biological research in the space ship, which means the ship and return to Earth, and the ship and return to Earth | 1 Jan. 1960 | 122 (75,800) | 1471 (913,300) | 47.2 |
| 10 | Fourth satellite (Soviet 10) | Development of a space station | 4 Jan. 1960 | 122 (75,800) | 1471 (913,300) | 47.2 |
| 11 | Space station (Soviet 11) | Study of methods of orbiting in the atmosphere, and the study of the laws of motion of celestial bodies in the atmosphere, and the study of the laws of motion of celestial bodies in the atmosphere | 13 Feb. 1960 | | | |
| 12 | Fifth space ship (Soviet 12) | Development of the design of the space ship, which means the ship and return to Earth, and the ship and return to Earth | 3 Mar. 1960 | 217 (134,870) | 452 (280,900) | 43.3 |
| 13 | Sixth space ship (Soviet 13) | Development of the design of the space ship, which means the ship and return to Earth, and the ship and return to Earth | 10 Mar. 1960 | 217 (134,870) | 452 (280,900) | 43.3 |
| 14 | Space ship (Soviet 14) | Study of the laws of motion of celestial bodies in the atmosphere, and the study of the laws of motion of celestial bodies in the atmosphere | 13 Apr. 1960 | 122 (75,800) | 1471 (913,300) | 47.2 |
| 15 | Space ship (Soviet 15) | Study of the laws of motion of celestial bodies in the atmosphere, and the study of the laws of motion of celestial bodies in the atmosphere | 4 May 1960 | 122 (75,800) | 1471 (913,300) | 47.2 |
| 16 | Space ship (Soviet 16) | Study of the laws of motion of celestial bodies in the atmosphere, and the study of the laws of motion of celestial bodies in the atmosphere | 10 Mar. 1960 | 122 (75,800) | 1471 (913,300) | 47.2 |

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EQUIPMENT



WINDUP SCREEN is positioned directly in front of the cockpit seat. Infrared photo cell (1) detects and lamp on headlamp system (2), moving the screen to compensate for vertical head motion by the pilot.

Cockpit Fog Simulator Facilitates FAA's Study of Runway Lighting

Atlantic City, N. J.—Fog simulator installed in the cockpit of a Douglas C-47 testbed aircraft will be used here to assist Federal Aviation Agency's Aviation Research Development Service (ARDS) in evaluating lighting systems for runway approach and touchdown zones.

The simulator, which employs a moving strip of stained Mylar film to create a speed-of-lighting fog pattern in the pilot's normal visual field, was developed by Link Development of General Precision, Inc., Binghamton, N. Y. It is the outgrowth of a feasibility study conducted by Link and Franklin Institute of Philadelphia under an FAA contract.

ARDS is scheduled to begin a new series of evaluation flights here this month to check out lighting systems at FAA's National Aviation Facilities Experimental Center (NAFEC). Test personnel are seeking to determine which lighting materials, intensities and configurations are most helpful in ensuring visibility landings.

Ultimate goal of the program is to

establishment of a standard U.S. runway lighting system which later might be submitted for consideration as an international standard.

Smoke Tests

In previous tests, ARDS attempted to use natural fog or to simulate its effect by placing smoke generators alongside the test runway. Fog and smoke, however, create different light diffusion effects. Also, there was no method available for continuously displacing fog patterns, so test data was of relatively little value.

"The fog simulator should give us the ability to conduct controllable experiments under actual VFR conditions," says Lt. Col. Richard S. Griffith USAM, chief of the reports system in the ARDS organizational domain. "We'll have to test all lighting systems under the same conditions before we can honestly decide which is best," he said.

The simulator is designed to provide the researcher, Pilot's Eye view, each condensing to a different visibility

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- range have been developed to date.
- **High IFR**—2,000 to 3,000 ft. every seven minutes.
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- **Low IFR**—100 to 600 ft. in seven minutes.

The 8-in. wide clear film was spaced with a non-punctured layer which holds in effect precisely the same as natural fog. Spacing was accomplished with a gas automatically controlled by a computer. Spacing rate was programmed to cool the film with densities that ran as much as a ratio of 1:10. If each roll contains 310 in. of film treated to simulate a typical fog pattern—lighter at the bottom of the film denser at the top.

Film density also varies with altitude, so that higher altitude produced a proportionally darker film. Film rolls can be changed in a few minutes.

Simulator Components

The task simulator which has a 40-mg. press requirement consists of three basic sections:

- **Three analog computers**, carried on cargo pallets in the C-54's midsection. These are linked individually with the aircraft's altimeter, horizontal gyro and vertical gyro. Altitude changes sensed from the altimeter trigger signals from the computer to the servo system which drives the film mechanism in the cockpit. These signals can accelerate, retard or reverse film movement across the viewing screen to present an accurate lag picture during approach and landing. The other computers, linked to the altimeter gyro, work through servo systems to compensate for pitch and roll by moving the screen in vertical and horizontal planes so that the lag picture remains constantly in the pilot's direct line of vision.

- **Control pedestal**, mounted between the pilot's and copilot's seats and anchored in the housing normally occupied by the autopilot control head. The pedestal contains the servo system which powers the pitch and roll compensators and the main simulator control panel.

- **Film mechanism**, connected to the control pedestal. This section houses the film drive film rolls and an infrared photo cell. The photo cell is tied into the pitch and roll compensators and a small roll loop attached to the pilot's left headgear. The roll follows his head movements by tracking the loop and automatically scans or lenses the screen to assure that the pilot always views objects as they ground through the view port of the screen while making his approach and landing.

*This arrangement prevents the pilot from inadvertently "slipping" his task-

Task's new, lightweight, self-modulating valve regulates the mass flow of cabin air discharged overboard, thereby maintaining stable compartment pressure. The device insures smooth, reliable performance through the use of a butterfly valve with modulating control that adjusts to varying pressure and flow rate without employing electronic servo components. The valve is fully automatic and controls the air flow rate in a smooth, continuous line from 55 pounds per minute at sea level (with virtually no pressure drop), to a maximum of 1 pound per minute when the pressure drop across the valve reaches 2.8 psi. Cam-actuated switches may be provided to indicate valve position. A manual override feature is available for non-automatic operation. For complete specifications, write: Task Corporation, 1009 E. Vermont Ave., Anaheim, Calif.



Shown with manual override

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hi-shear developed Electro-Combustion Devices serve a dual function. First, they act as high strength fasteners, connectors or as a means of containment. Secondly, on command, the devices are electrically initiated, releasing energy produced by combustion to mechanically push, pull, spin, separate, sever, restrain, restrain, components or activate other functional systems.

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SEPARATION NUT
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THRUSTOR
Provides a means of separating a component from a threaded member. It is used to separate the component from the threaded member.



NUT ON CABLE SEPARATOR
Used to separate a nut from a cable. It is used to separate the nut from the cable.



TIME DELAY
Used to delay the separation of a component from a threaded member. It is used to delay the separation of the component from the threaded member.



NUT ON CABLE SEPARATOR
Used to separate a nut from a cable. It is used to separate the nut from the cable.



POWER INITIATOR
Provides a means of separating a component from a threaded member. It is used to separate the component from the threaded member.



PIN PULLER
Provides a means of separating a component from a threaded member. It is used to separate the component from the threaded member.

Big format movie under the stars" system. B&B Finisher, a Link screw mechanical engineer. Fushion and Arnold Deutsch screw electronics on garter from the company, recently installed and checked out the welder in the NAFEC project.

Copilot Role

The copilot will be used as the "main eye" in lighting sensor illumination flights using the welder. The sensor is positioned directly in front of the seat at a range of about 30 in. If necessary, the sensor can be quickly swung back into the space between the two seats to leave the forward cockpit window completely unobstructed.

As the copilot makes his approach and landing through the wind-tunnel conditions imposed by the Link device, his actions and responses on the plane's controls will be monitored by various types of recording equipment at the plane and on the ground.

The recorded data will be analyzed by psychologists and technicians to determine how good the subject pilot was able to detect and interpret different lighting situations, or more precisely, how much help such action provided to be in a log approach and landing.

"He is studying some man's opinion on what's best in terms of lighting is just about as good as any other's," Corbett told Associates' Wiles. "Now FAA is going to put it."

Training Device

A number of ARDS efforts believe the log simulator also offers definite possibilities as possibly a training device — a method of developing and rehearsing a pilot's skill in making landing approaches in light or heavy fog cover.

The NAFEC simulator is the only one produced in this Link. However, the company has built some foreign countries and U.S. companies have requested interest in the device.

Dr. Robert K. McKee, chief of human factors research branch at the ARDS research division feels the simulator has some potential for not only training flights with sensitive landing systems. Such systems are currently under development in several countries.

Another possible application for the simulator could be support of a program similar to the present one at NAFEC, to evaluate helicopter lighting system. Use of the device in such a program probably would reduce external modifications to reduce the area's light's overall use and to reduce and avoid the viewing system to couple with the configurations of a helicopter cockpit.

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Frederick Devices, Inc., 10000 W. 1st Ave., Portland 2, Ore.



Satellite Timer

New microelectronic timing device designed to track on satellite and space vehicle events in either frequency or predetermined time and to shut down these systems once they have completed their useful operation.

The manufacturer says the timer has a reliability of 99.9% and useful lifetime of several hours to as much as three years. The device occupies 4 in. x 4 in. x 1/2 in. weight 120 grams. Power requirements vary from approximately 25 milliwatts for delays of several hours to about 5 milliwatts for a delay of less than one year.

Miller Research Laboratories, 2832 Main St., Bismarck 10, N.D.



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Telstar Facility in Maine Nears Operation



CENTRAL CENTER control center consists (foreground) to display received TV pictures, to control satellite operations and coordinate its orbital performance via telemetry. At far end is IBM 3620 computer which will calculate ephemeris data and predict satellite signal times over the 510-mile-long communication satellite ground tracks.



NEW BELL SYSTEMS ground terminal for communication satellite tests of Telstar and Project Relay satellites, located near Andover, Mass., includes (1) control center, (2) acquisition and telemetry antenna, (3) precision tracking antenna and (4) large horn antenna for broadcasting and receiving voice and television signals. New facility is slated for operation shortly. Horn antenna largest precision antenna of its type ever built will be used to transmit and receive signals to and from the satellite. The 177 ft. long 340-ton structure, built by McGraw-Hill, and identical to one now being constructed in France to position the tests, currently is being used as a radio telescope to track stars.



By Philip J. Kline

Andover, Me.—Bell System's new \$18 million communication satellite ground terminal opening completion here is expected to be fully operational by June, when its Telstar satellite is scheduled to be launched.

A state-of-the-art facility is under construction at Lanes, France, and is expected to be completed by August.

The new facility here, situated in a secret level located by low basement approximately 50 ft. north of Fort Belknap, was located in this remote site to minimize interference from existing microwave facilities and other man-made sources.

The 180-ton horn antenna, located in a 210-ft. dia. aerodynamic enclosure (AW Feb. 12 Cover and p. 75), currently is being used as a radio telescope to track stars as a means of checking out its performance and the operation of an IBM 1620 computer, which will be used to orient the antenna during communication satellite tests.

Project Relay Function

The new Andover terminal will be used to test the National Aeronautics and Space Administration's Project Relay communication satellite under construction by Radio Corp. of America in addition to the Telstar satellite.

The large horn antenna, which will both transmit and receive satellite communication signals, will be controlled and directed from a console building located approximately a quarter of a mile away.

The control center has two small tracking antennas. One, a quad helix type, will be used to acquire the satellite initially. In cases of low power, continuously operating, cross-track loss can translocate on 150 mc.

This antenna also will be used to transmit commands to the satellite to turn on its 4,600 mc precision tracking beacon.

Once this has been accomplished, the satellite will be tracked by a precision drift antenna, the second located at the control center, which is designed to establish satellite position to within 0.01 deg., according to Bell System officials.

Signals from the antenna can be used to orient the large horn into approximate alignment with the satellite but precision alignment is achieved by a corner reflector antenna operating directly from signals received from the satellites' own transmitter. An eight

Tourist Attraction

Andover, Me.—Bell System's new communication satellite ground terminal here is expected to prove a tourist attraction, according to American Telephone & Telegraph Co. Its convenient location for visits to communication centers and where the operation of communication satellites can be explained to those visiting domestic exhibits. Visitors to the control center can also view television pictures as they are being received from the satellite and watch antenna at their control consoles without disturbing the operators.

On the first Sunday that the new facility was open, nearly 1,000 visitors toured and another 700 appeared the following weekend.

Improvement changes the propagation mode through a magnetic structure to the throat of the horn, producing an exact signal and to shift horn position slightly.

Satellite position data from the precision tracking antenna also will be fed to an IBM 1620 digital computer which will calculate ephemeris data on the satellite.

When the satellite's orbit position has been determined with sufficient accuracy it is expected that the computer will then be used to orient the horn antenna based on the predicted position of the satellite on the next pass.

Minimizing Noise

The Andover facility will transmit to the satellite on a frequency of 4,700 mc using a radiated power of 2 kw. over a 25 sec. bandwidth. The receiver will use a ruby mixer (low noise amplifier) cooled to -45K. To minimize the



RUDY HAIER, cooled to -45K, is located in the cabinet in the upper "house" located at the throat of the large horn antenna. Receiving and transmitting equipment will be located in upper housing of tips of horn, while lower house will contain control console (see bottom photo, p. 166).

pickup of external noise, the ground terminal uses a narrow-band receiver with a frequency modulation filter circuit which enables it to automatically tune very rapidly to the particular frequencies being transmitted by the satellite or its carrier.

Equipment Location

The transmitter and receiver are located in a 25 x 12 ft. metal house located at the tip of the horn antenna (AW Feb. 12, p. 77).

The control room, in addition to its tracking and computing facilities, contains consoles and displays which will

enable Bell Telephone Laboratories visitors to control the operation of the Telstar satellite and to monitor its internal performance via telemetry.

The facility is hailed by engineers to the Bell System's regular telephone facilities and receiving network, which will permit a direct link between the facility and a similar receiving station at Holmdel, N. J. Voice and television signals can be transmitted simultaneously via both the facility and direct land routes for side-by-side comparison of quality of received signals. The details on the Telstar satellite will be in AW Mar. 25, p. 73.

HOLLEY VALVE "ROLLS" THE VZ-10 "HUMMINGBIRD"



ROLL CONTROL DEVICE HAS WIDE APPLICATION

The VZ-10 "Hummingbird", Lockheed's versatile, high-speed research VTOL aircraft now under construction for the U. S. Army, uses a Holley-developed "Roll Control" valve in each wing tip, to provide attitude control during vertical take-offs and landings and in hovering flight maneuvers.

The new design offers several advantages over existing control devices of this type:

1. Thrust versus valve travel is linear.
2. Efficiency is comparable to plug nozzles.
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These characteristics, combined with a high tolerance to contamination, make the valve adaptable to a wide variety of applications.

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Thermionic Converter Readied for Space

By Ben Miller

Powerless, cold—disregarded solar energy. Thermionic converter systems which were left to flounder models capable of supplying large amounts of electric power for spacecraft operating near Mars or Venus is coming on-line here.

The system, called SET (Solar Energy Thermionic converter system) is being developed for National Aeronautics and Space Administration's Jet Propulsion Laboratory by Electro-Optical Systems Inc. under a \$715,000 contract awarded last year (ENR Feb. 20, 1961, p. 51 Feb. 5, p. 87).

Thermo-Electronics Engineering Corp., Wilton, Mass., is a major subcontractor responsible for design and fabrication of a thermionic generator for the system.

Although it is not intended for JPL's Mariner program or any other specific space program, the system was conceived and engineered to satisfy flight conditions. Its design falls within an envelope of parameters suitable for an Atlas-Centaur boosted Mariner spacecraft.

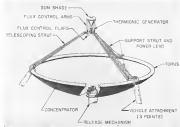
System Components

The system consists of a flat-plate collector, a thermionic generator, which can be extended from a folded position to the collector's focus, and auxiliary equipment. Solar energy is reflected and concentrated into the generator where it heats cathodes of various vapor character densities and causes them to emit electrons and deliver current to an external load.

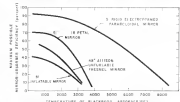
Components of two such systems can be folded together somewhat like a dumbbell for storage before use in space. Power available from the two systems, or modules, would be double that of a single system. A similar major mission might employ four modules with their concentrators in dumbbell configurations on either side of the spacecraft.

For the JPL program, two concentrators have been completed, tested and delivered to JPL by Electro-Optical. The thermionic generator is being assembled by Thermo-Electronics and will be tested by Electro-Optical.

When fully assembled and tested the system is not expected to meet all its goals, including overall system efficiency and power output, largely because of the inability to push thermionic diode development far enough to meet extremely stringent specifications. The specifications for both the concentrator and the thermionic generator were



SOLAR THERMIONIC CONVERTER components include telescoping strut, above left. Below, possible power efficiency vs. sun as a function of temperature.



SOLAR ENERGY THERMIONIC CONVERTER designed to convert sunlight into electrical power for a spacecraft operating near Mars employs 1.1 in. dia. parabolic mirror (torus) which focuses sunlight onto cathodes of thermionic diodes.



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thru to parallel and be held in place by a locking device.

In space, the diodes are expected to suffer a 1% per year degradation in efficiency as a result of atomic erosion and collisions with intermolecular.

To achieve its original goal of 150 watts, with an overall system efficiency of 19%, the thermionic generator would have had to operate at a generator efficiency of 21%, a figure in excess of known thermionic capabilities. The generator design requires five series-connected cesium vapor thermionic diodes, each of which was expected to develop over one volt and deliver approximately 20 watts to a load.

The generator being assembled will employ diodes operating at efficiencies of roughly 16% to 17% and deliver a total of about 60 watts.

Lifetimes Extended

Lifetimes of the thermionic diodes are being extended by Thermo-Electron. Subjected to thermal cycling, one diode operated for a total of 800 hr. in two separate continuous runs before a failure, which Thermo-Electron attributes to the wiring technique, not an inherent fault of the diode. Another diode has operated for 575 hr. also two or three months longer. Company says diode life may be pushed to 10,000 hr.

A flux control mechanism which can control temperatures inside the generator cavity by $\pm 1.5^\circ$ is undergoing preliminary experiments. A control device of this type is necessary to maintain the temperature of the cavity within the limits of a constant temperature over the wide variation in reflectivity of solar energy on a planetary surface. The flux control has steps which will open and close, as a function of the solar energy being received.

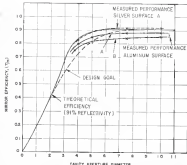
The generator radiator was shielded from the sun by a heat shade to protect them from being heated.

Three Requirements

To perform successfully in space the solar thermionic generator must have three important requirements satisfied. These are:

- **Powering accuracy.** Spacecraft must be capable of receiving the collector to send the sun far flux meters to its accuracy of plus or minus 0.1 unit.
- **Circuit control.** Current supply for the diodes, which linear cathode work function, should be at controlled temperatures.
- **Solar flux control.**

In a station of this type, there are several types of energy losses. There is direct energy absorbed by the collector (reflected loss), energy lost due to geometric imperfections of the collector (spillover loss), radiation from the earth, atmosphere and losses associated with the generator. The choice of cathode



PERFORMANCE OF TWO TYPES OF SOLAR THERMIONIC GENERATORS versus cavity aperture diameter efficiency and a design goal curve. Measured performance for silver coated surface (A) same surface coated with aluminum (B) and another coated with cesium diodes (C).

aperture size is a tradeoff of some of these losses to the extent that radiation is contained in the hole is made smaller and spillover losses can be used as the hole is made larger to contain more reflected energy.

The relative magnitude of these losses is indicated by the system open diodes which permitted a warmer aluminum efficiency (highlight) over the earth's thermal radiation all divided by sunlight on reflective surface of 59% and a generator efficiency (electrical power output) divided by sunlight into the cavity low thermal radiation of 21% to give overall system efficiency of 15%.



• **Ballistic Missile Radar Cross Section—Air Force's Ballistic Missile Division will build satellite Apr. 19 as an upcoming program to determine radar cross section of a large number of aircraft load shapes. The program will be handled out of the NAE's own support branch of the research vehicles department.**

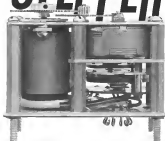
• **Threading Wave Meters for Space Tracking—Three broad-band, low-loss traveling wave meters will be fabricated for Jet Propulsion Laboratory in Micro-wave Electronics Corp., Palo Alto,**

Calif. The meters will be used to increase standards of JPL's Deep Space Instrumentation Facility research.

• **Aviation Company's Share Control Study—A study of aerospace and aviation companies, active in current government funded communications programs and other satellite efforts have declined to bid on an Advanced Air-Space Corp. communication satellite program originating in Ft. Monmouth, N.J. The study is in order to give type of communication satellite, active and passive high and low altitude. Facing strong union companies which might survive, he expected to bid but which have declined to do so that the study is serving the task to have potential increasing for control programs.**

• **USAF's Civil Science Coordination Problems—Recent Space scientific journal concludes that there is a serious amount of duplication of capabilities going on in Soviet laboratories and in civil for its distribution and the coordination of scientific research with production. The article says there are now about 140,000 technicians employed in about 2,000 scientific research organizations in the Soviet Union. English translation, entitled New Problems in the Coordination of Scientific Research, was identified 52,111,015 and is planned for 98 items from Office of Technical Services, Commerce Dept. Washington 25.**

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Stepping devices from A. W. Haydon Co. can do wonderful things to pulsed DC, pulse trains, and for pulses. For instance, one precision gated stepping switch acts as a pulse divider for a random or variable pulse source—or as a frequency divider if the pulse source is constant. Another works in conjunction with pulsed, supplying single or multiple switch closures with an accuracy virtually equal to that of the pulse source itself. Still a third will count a predetermined number of pulses, initiate a trigger switch, return the counter to zero, and cut off the pulse source. ■ The remote positioning device illustrated is just one of A. W. Haydon Company's fancy steppers. Here a precision gated stepper switch has been coupled to a synchro transducer. Similarly, precise angular positioning of rotary systems (such as potentiometers, shafts and indicators) can be controlled. Based only on the number of pulses received (and incremental changes in voltage or phase angle), it will hold a set position whether power is on or off, and will home the synchro to the zero reference on demand—ready to accept another setting. ■ All A. W. Haydon Co. stepper motors are all electric—no relays, linkage, contacts or other mechanical elements are used. These power components are low, accurate to extremely high. ■ Send for technical brochure SPS-1 and find out these about pulse driven stepper and their applications.



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■ **This Sun sensor**, type BHM-100, with capacity of 1.675 ft², has a cycle time of only 0.2 microseconds, making it suitable for high-speed steering. The six 1-mw thin film pins can be driven by single pinhole pulsed. Price: a \$1,500. Manufacturer: Remington Corp., Electronic Components Div., Plainfield, N.J.



■ **Wideband traveling wave tube**, Type L-1711, provides 16 db maximum small-signal gain in the 4 to 6 kmc band. The tube measures 22 1/2 in. long and 1 in. in diameter, weighs 21 oz. and uses all metal-ceramic construction. Manufacturer: Litton Industries, Electronic Tube Division, San Carlos, Calif.

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MANAGEMENT

Federal Role in Aerospace Labor Studied

By Russell Howles

Los Angeles—Representatives of both aerospace industry management and the labor union functioning within the industry are closely scrutinizing the role of government in labor negotiations that went, according to an *Aerospace* Weekly poll, which included industry executives, union leaders and outside labor experts.

Common view is that growing involvement with the federal government of Defense Department and National Aeronautics and Space Administration upon collective bargaining may make this an area of great importance this year. Correspondent in this in the national business-headlines of *Michigan-United Auto Workers* program to induce government to pressure proposed employer activity.

Union demands for government pay and increased supplemental benefits were major issues in the recent failure of IAM Lodge 1987 and Republic Aviation Corp. officials to agree on a new contract at Long Island, N.Y., plant. About 9,000 production workers struck at Republic on Apr. 1 when negotiations reached a stalemate (AW Apr. 9, p. 3).

All union leaders and many of the company officials contacted and the contracting agencies themselves say their control over the availability of additional costs to defend and space contracts to determine the settlement of his points in labor-management bargaining. IAM President Al Hines said that his union is prepared to make the unilateral extensions of contracting agencies a high priority issue if there is evidence of it in 1985 bargaining.

Hines and the government is studying the intention of the Taft-Hartley Act by drawing its management right activities the freedom to bargain in good faith when a contracting agency relies on the availability of additional costs resulting from collective bargaining. He said that in some cases, companies have used the uncertainty availability of additional labor costs as a new device to oppose union proposals but in other cases they have been previously bound by cost reductions imposed by defense agencies.

Also for the record, UAW Vice President Leonard Woodcock said that if contracting agencies of the government do not withdraw their reliance upon labor-management bargaining ac-

tion must be taken to make them a fair and just to negotiation. The industry executives were unanimously opposed to making the government take sides at the bargaining table.

The government was again to be an unwilling conflict between the Taft-Hartley Act and the last government government last. None of the unions contacted had any suggestions about how labor-management efforts can meet the agencies that they derive on the availability of costs on certain contracts without also reducing company's contracts. A union official said the detailed mechanism of government contracting was not a proper subject for external labor to make recommendations upon. Labor Secretary Arthur Goldberg has established an anti-discrimination program to force to reach the problem.

Defense Department plans to pay United Aircraft Corp. \$7.5 million to cover strike costs are being cited by union officials as another example of government's involvement in bargaining. Since the strike cost prevent it being regarded as an allowable cost increase, the unions are protesting it is an example that the government must also impact upon upon its collective bargaining.

They claim that government buys 90% of the output of the aerospace industry and regulates air traffic in equipment and facilities therefore it has a special responsibility for the activity of aerospace employees.

At a recent aerospace industry labor conference sponsored by Douglas Aircraft Co. in Kansas the general background of defense industry-labor problems. If labor agencies were unable to participate but industry representatives were specifically excluded. One

labor relations expert said, "If industry management people had attended the meeting would have been there in relation and the possible nature of the conference would have been noted." The conference was similar to a type of round-table meeting proposed by President Kennedy to enable labor and management to find areas of general agreement and cooperation.

Some observers believed the Douglas conference was intended to forestall government initiation of employee which would have compelled actions. Douglas is likely to sponsor similar conferences in the future but most authorities agreed that the usefulness of such conference is compromised when they are sponsored by a single private company. No major unions contacted from outside the Los Angeles area attended, though a number of important representatives from the East Coast were represented.

The role of government acting through its labor agencies was the subject of speculation among the industry and labor associations questioned by *Aerospace Weekly*. The government's major role in recent years industry negotiations has been confined either by aerospace industry and labor officials. The government's direct influence in settlement of the steel industry dispute indicates that it will also likely heavily in negotiations within the aerospace industry as contracts come up for renewal (AW Feb. 19, p. 3).

Several aerospace industry relations officers say they will watch labor contract negotiations at Douglas's work area for its industries of Administration activities as well as for direct representation of the labor union in the contract. To back professional staff between unions on the ground since last year, the government signed "Mazda-Sen Contract" at such as labor and labor, management, and public representatives.

The committees are directed to prevent stoppage by the industry action of the participants and have to proceed in contract arbitration, but unlike the Federal Mediation and Conciliation Service which can act only as an aid to communication between the parties the committees can bring some pressure to bear in favor of a specific solution. Union officials and FMCS employees have no right to call the committees into contract negotiations. However if a dispute should arise it is quite likely to be done.

Labor and industry officials continue

TRW Earnings Drop

Thompson Research Wootledge Inc. reported last earnings of \$6,479,000 in 1984 on sales of \$499,877,000, a decrease from 1983 net earnings of \$18,177,800 on \$420,491,000 sales. Net income per common share outstanding in 1984 was \$1.55 compared with \$1.13 for the previous year.

Board Chairman J. D. Wright stressed the decline in earnings to unexpected problems in the company's electronics sector, including setbacks in Mississauga, ICBM bid orders and transferred or reduced funding of several military electronic contracts.



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The great industry-wide program of the titanium structure protection of work is again being strengthened due to local fluctuations in the business volume of aircraft, missile and space. The long-term industry-wide Segmented Unemployment Benefits (SUB) which a valid guarantee, a lead-off worker a volume of 60,700 of his previous time base go in contrast for is agreed to be critical for the industry.

A once official and this is the original level of base unemployment benefits established during the Roosevelt Administration but it, and the actual percentage value of them, had decreased over the years. An alternative alternative is an administrative fund to be established by uniform contributions from employers for the purpose of providing cash benefits to unemployed aerospace workers. Government would be asked to maintain payments out of the fund or more, if an unemployment analogue to the insurance of bank deposits by the Federal Deposit Insurance Corp. There is general agreement that this plan is too big to be run without government participation. Industry representatives are firmly opposed to the proposal and a union leader admits that this is "a

protested a year of labor peace in the aerospace industry. However, government liberal officials questioned by Secretary Wicks disagreed. This protest didn't negotiate and possibly strike has taken to discuss what action they might take if work stoppages threaten.

Those who anticipate less negotiation from an labor-management coalition in the aerospace industry line guess shifts were placed in recent years and the obvious national interest in defense and space is creating pressure in favor of peaceful settlement. A management official and both the IAM (UAW) program and industry programs appear broad enough to leave little room for negotiation. However, some specific demands will remain unmet until they are given higher for tactical reasons. At times, a big industrial union may make partly local issues the hardest to solve. Continuing drive for union shops could be a big industrial issue but at present it appears to be a secondary objective for IAM and UAW.

Woodcock conceded that declining union membership is reducing the raw power that organized labor brings to the bargaining table. In some important aerospace industry negotiations only 40% of eligible employees belong to the union. Since 1950, while other work, cos. who have pinned hard to organize, management officials admit, membership in U.S. industry and the disparity is growing larger because of advancing technology which is most evident in the aerospace business. This raw power in part for the growing instability of aerospace union.

The great industry-wide program of the titanium structure protection of work is again being strengthened due to local fluctuations in the business volume of aircraft, missile and space. The long-term industry-wide Segmented Unemployment Benefits (SUB) which a valid guarantee, a lead-off worker a volume of 60,700 of his previous time base go in contrast for is agreed to be critical for the industry.

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A4D-5 Carries Two Bullpups, 18 Bombs

New Douglas A4D-5 Skyhawk attack aircraft's maximum capacity of two Northrop Bullpup missiles and 18 bombs is shown in the photo. The aircraft is shown in flight, banking slightly, with the missiles and bombs clearly visible under the wings. The aircraft is dark in color, possibly black or dark grey.

long-term proportion with only a road union, claims of being accepted this year. Professional aerospace companies are unwilling to work in an uncertain future, and the plan is too ambitious to be possible.

IAM and UAW leaders are discussing other job security measures including an employment pool of laid-off aerospace employees, and a system of rights to set new jobs created in the industry by redistribution of government business according to geography or the needs of private industry. An end to mobility of labor this first government program of transfer expenses, including per diem between jobs.

An industry labor union executive said adoption of the IAM/UAW job security idea could be a step toward a national federal program to reduce the long-term unemployment due to automation and other factors. A vote on this proposal in the three-year job security act in Congress to return 60,000 additional dollars for new jobs. Aerospace industry spokesmen questioned view all government about the outcome of an long-term federal program to return public workers in higher skills given the advantages of a single national pool, has been largely frustrated so far by such variable but growing getting a solution from the different levels of proposals, opposed by aerospace companies, the presence of risk, and such unions in some shops, differing interests of government and commercial interests, and regional or even in the labor market. However, labor contract renewal dates for many years are different companies. Boeing, General Dynamics, North American, Douglas, Lockheed, and United Aircraft along with some other important aerospace companies are beginning to discuss in the months of June and July.

that this because unions say that most in the aerospace industry are lagging behind the general trend of wages in other industries.

Expected for a union shop will agree be part of the national union program but the prospects of acceptance are slight. There will also be continuing pressure from such unions to prevent such employment as a permanent pool to firms outside the production of the union, continued to the union contractor.

Institution for this position is that of National Labor Relations Board certifies an industrial union to represent all workers along production and maintenance work for a company, subcontracting outside unions jurisdiction is a violation of the certification. This vote government continues often specify that certain part of the labor of such contract will be subcontracted. A company industrial relations expert argued that his company need do some subcontracting when work volume is made a certain level to absorb all peaks and valleys in the use of the work force and the amount of tooling.

Longstanding effort to labor to increase contract rates and union size to do deal with the general industry a single national pool, has been largely frustrated so far by such variable but growing getting a solution from the different levels of proposals, opposed by aerospace companies, the presence of risk, and such unions in some shops, differing interests of government and commercial interests, and regional or even in the labor market. However, labor contract renewal dates for many years are different companies. Boeing, General Dynamics, North American, Douglas, Lockheed, and United Aircraft along with some other important aerospace companies are beginning to discuss in the months of June and July.

This spacecraft, SURVEYOR, one of the many important projects now under way at Hughes, will "soft" land on the moon sometime in 1963. Its mission: to perceive and analyze the moon's surface; to transmit back to earth high quality television pictures; and to measure the moon's magnetic and radiation characteristics. To accomplish these demanding objectives, Project Surveyor requires the talents of many imaginative junior and senior engineers and physicists to augment its outstanding staff. A degree from an accredited university and U.S. citizenship are required. Experience in Aerospace Vehicles is preferred but not necessary. A few of the activities include:

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AVIATION WEEK, APRIL 16, 1962

| | | | |
|--|-----|---|-----|
| 4. J. THE ELECTRONIC DIVISION OF CON RAD ELECTRIC CORPORATION | 127 | 1. AIRCRAFT GENERAL COMPANY, A DIVISION OF AIRCRAFT GENERAL CORPORATION | 131 |
| 5. AIRCRAFT GENERAL COMPANY, A DIVISION OF AIRCRAFT GENERAL CORPORATION | 131 | 2. AIRCRAFT GENERAL COMPANY, A DIVISION OF AIRCRAFT GENERAL CORPORATION | 131 |
| 6. AIRCRAFT GENERAL COMPANY, A DIVISION OF AIRCRAFT GENERAL CORPORATION | 131 | 3. AIRCRAFT GENERAL COMPANY, A DIVISION OF AIRCRAFT GENERAL CORPORATION | 131 |
| 7. AIRCRAFT GENERAL COMPANY, A DIVISION OF AIRCRAFT GENERAL CORPORATION | 131 | 4. AIRCRAFT GENERAL COMPANY, A DIVISION OF AIRCRAFT GENERAL CORPORATION | 131 |
| 8. AIRCRAFT GENERAL COMPANY, A DIVISION OF AIRCRAFT GENERAL CORPORATION | 131 | 5. AIRCRAFT GENERAL COMPANY, A DIVISION OF AIRCRAFT GENERAL CORPORATION | 131 |
| 9. AIRCRAFT GENERAL COMPANY, A DIVISION OF AIRCRAFT GENERAL CORPORATION | 131 | 6. AIRCRAFT GENERAL COMPANY, A DIVISION OF AIRCRAFT GENERAL CORPORATION | 131 |
| 10. AIRCRAFT GENERAL COMPANY, A DIVISION OF AIRCRAFT GENERAL CORPORATION | 131 | 7. AIRCRAFT GENERAL COMPANY, A DIVISION OF AIRCRAFT GENERAL CORPORATION | 131 |
| 11. AIRCRAFT GENERAL COMPANY, A DIVISION OF AIRCRAFT GENERAL CORPORATION | 131 | 8. AIRCRAFT GENERAL COMPANY, A DIVISION OF AIRCRAFT GENERAL CORPORATION | 131 |
| 12. AIRCRAFT GENERAL COMPANY, A DIVISION OF AIRCRAFT GENERAL CORPORATION | 131 | 9. AIRCRAFT GENERAL COMPANY, A DIVISION OF AIRCRAFT GENERAL CORPORATION | 131 |
| 13. AIRCRAFT GENERAL COMPANY, A DIVISION OF AIRCRAFT GENERAL CORPORATION | 131 | 10. AIRCRAFT GENERAL COMPANY, A DIVISION OF AIRCRAFT GENERAL CORPORATION | 131 |
| 14. AIRCRAFT GENERAL COMPANY, A DIVISION OF AIRCRAFT GENERAL CORPORATION | 131 | 11. AIRCRAFT GENERAL COMPANY, A DIVISION OF AIRCRAFT GENERAL CORPORATION | 131 |
| 15. AIRCRAFT GENERAL COMPANY, A DIVISION OF AIRCRAFT GENERAL CORPORATION | 131 | 12. AIRCRAFT GENERAL COMPANY, A DIVISION OF AIRCRAFT GENERAL CORPORATION | 131 |
| 16. AIRCRAFT GENERAL COMPANY, A DIVISION OF AIRCRAFT GENERAL CORPORATION | 131 | 13. AIRCRAFT GENERAL COMPANY, A DIVISION OF AIRCRAFT GENERAL CORPORATION | 131 |
| 17. AIRCRAFT GENERAL COMPANY, A DIVISION OF AIRCRAFT GENERAL CORPORATION | 131 | 14. AIRCRAFT GENERAL COMPANY, A DIVISION OF AIRCRAFT GENERAL CORPORATION | 131 |
| 18. AIRCRAFT GENERAL COMPANY, A DIVISION OF AIRCRAFT GENERAL CORPORATION | 131 | 15. AIRCRAFT GENERAL COMPANY, A DIVISION OF AIRCRAFT GENERAL CORPORATION | 131 |
| 19. AIRCRAFT GENERAL COMPANY, A DIVISION OF AIRCRAFT GENERAL CORPORATION | 131 | 16. AIRCRAFT GENERAL COMPANY, A DIVISION OF AIRCRAFT GENERAL CORPORATION | 131 |
| 20. AIRCRAFT GENERAL COMPANY, A DIVISION OF AIRCRAFT GENERAL CORPORATION | 131 | 17. AIRCRAFT GENERAL COMPANY, A DIVISION OF AIRCRAFT GENERAL CORPORATION | 131 |
| 21. AIRCRAFT GENERAL COMPANY, A DIVISION OF AIRCRAFT GENERAL CORPORATION | 131 | 18. AIRCRAFT GENERAL COMPANY, A DIVISION OF AIRCRAFT GENERAL CORPORATION | 131 |
| 22. AIRCRAFT GENERAL COMPANY, A DIVISION OF AIRCRAFT GENERAL CORPORATION | 131 | 19. AIRCRAFT GENERAL COMPANY, A DIVISION OF AIRCRAFT GENERAL CORPORATION | 131 |
| 23. AIRCRAFT GENERAL COMPANY, A DIVISION OF AIRCRAFT GENERAL CORPORATION | 131 | 20. AIRCRAFT GENERAL COMPANY, A DIVISION OF AIRCRAFT GENERAL CORPORATION | 131 |
| 24. AIRCRAFT GENERAL COMPANY, A DIVISION OF AIRCRAFT GENERAL CORPORATION | 131 | 21. AIRCRAFT GENERAL COMPANY, A DIVISION OF AIRCRAFT GENERAL CORPORATION | 131 |
| 25. AIRCRAFT GENERAL COMPANY, A DIVISION OF AIRCRAFT GENERAL CORPORATION | 131 | 22. AIRCRAFT GENERAL COMPANY, A DIVISION OF AIRCRAFT GENERAL CORPORATION | 131 |
| 26. AIRCRAFT GENERAL COMPANY, A DIVISION OF AIRCRAFT GENERAL CORPORATION | 131 | 23. AIRCRAFT GENERAL COMPANY, A DIVISION OF AIRCRAFT GENERAL CORPORATION | 131 |
| 27. AIRCRAFT GENERAL COMPANY, A DIVISION OF AIRCRAFT GENERAL CORPORATION | 131 | 24. AIRCRAFT GENERAL COMPANY, A DIVISION OF AIRCRAFT GENERAL CORPORATION | 131 |
| 28. AIRCRAFT GENERAL COMPANY, A DIVISION OF AIRCRAFT GENERAL CORPORATION | 131 | 25. AIRCRAFT GENERAL COMPANY, A DIVISION OF AIRCRAFT GENERAL CORPORATION | 131 |
| 29. AIRCRAFT GENERAL COMPANY, A DIVISION OF AIRCRAFT GENERAL CORPORATION | 131 | 26. AIRCRAFT GENERAL COMPANY, A DIVISION OF AIRCRAFT GENERAL CORPORATION | 131 |
| 30. AIRCRAFT GENERAL COMPANY, A DIVISION OF AIRCRAFT GENERAL CORPORATION | 131 | 27. AIRCRAFT GENERAL COMPANY, A DIVISION OF AIRCRAFT GENERAL CORPORATION | 131 |
| 31. AIRCRAFT GENERAL COMPANY, A DIVISION OF AIRCRAFT GENERAL CORPORATION | 131 | 28. AIRCRAFT GENERAL COMPANY, A DIVISION OF AIRCRAFT GENERAL CORPORATION | 131 |
| 32. AIRCRAFT GENERAL COMPANY, A DIVISION OF AIRCRAFT GENERAL CORPORATION | 131 | 29. AIRCRAFT GENERAL COMPANY, A DIVISION OF AIRCRAFT GENERAL CORPORATION | 131 |
| 33. AIRCRAFT GENERAL COMPANY, A DIVISION OF AIRCRAFT GENERAL CORPORATION | 131 | 30. AIRCRAFT GENERAL COMPANY, A DIVISION OF AIRCRAFT GENERAL CORPORATION | 131 |
| 34. AIRCRAFT GENERAL COMPANY, A DIVISION OF AIRCRAFT GENERAL CORPORATION | 131 | 31. AIRCRAFT GENERAL COMPANY, A DIVISION OF AIRCRAFT GENERAL CORPORATION | 131 |
| 35. AIRCRAFT GENERAL COMPANY, A DIVISION OF AIRCRAFT GENERAL CORPORATION | 131 | 32. AIRCRAFT GENERAL COMPANY, A DIVISION OF AIRCRAFT GENERAL CORPORATION | 131 |
| 36. AIRCRAFT GENERAL COMPANY, A DIVISION OF AIRCRAFT GENERAL CORPORATION | 131 | 33. AIRCRAFT GENERAL COMPANY, A DIVISION OF AIRCRAFT GENERAL CORPORATION | 131 |
| 37. AIRCRAFT GENERAL COMPANY, A DIVISION OF AIRCRAFT GENERAL CORPORATION | 131 | 34. AIRCRAFT GENERAL COMPANY, A DIVISION OF AIRCRAFT GENERAL CORPORATION | 131 |
| 38. AIRCRAFT GENERAL COMPANY, A DIVISION OF AIRCRAFT GENERAL CORPORATION | 131 | 35. AIRCRAFT GENERAL COMPANY, A DIVISION OF AIRCRAFT GENERAL CORPORATION | 131 |
| 39. AIRCRAFT GENERAL COMPANY, A DIVISION OF AIRCRAFT GENERAL CORPORATION | 131 | 36. AIRCRAFT GENERAL COMPANY, A DIVISION OF AIRCRAFT GENERAL CORPORATION | 131 |
| 40. AIRCRAFT GENERAL COMPANY, A DIVISION OF AIRCRAFT GENERAL CORPORATION | 131 | 37. AIRCRAFT GENERAL COMPANY, A DIVISION OF AIRCRAFT GENERAL CORPORATION | 131 |
| 41. AIRCRAFT GENERAL COMPANY, A DIVISION OF AIRCRAFT GENERAL CORPORATION | 131 | 38. AIRCRAFT GENERAL COMPANY, A DIVISION OF AIRCRAFT GENERAL CORPORATION | 131 |
| 42. AIRCRAFT GENERAL COMPANY, A DIVISION OF AIRCRAFT GENERAL CORPORATION | 131 | 39. AIRCRAFT GENERAL COMPANY, A DIVISION OF AIRCRAFT GENERAL CORPORATION | 131 |
| 43. AIRCRAFT GENERAL COMPANY, A DIVISION OF AIRCRAFT GENERAL CORPORATION | 131 | 40. AIRCRAFT GENERAL COMPANY, A DIVISION OF AIRCRAFT GENERAL CORPORATION | 131 |
| 44. AIRCRAFT GENERAL COMPANY, A DIVISION OF AIRCRAFT GENERAL CORPORATION | 131 | 41. AIRCRAFT GENERAL COMPANY, A DIVISION OF AIRCRAFT GENERAL CORPORATION | 131 |
| 45. AIRCRAFT GENERAL COMPANY, A DIVISION OF AIRCRAFT GENERAL CORPORATION | 131 | 42. AIRCRAFT GENERAL COMPANY, A DIVISION OF AIRCRAFT GENERAL CORPORATION | 131 |
| 46. AIRCRAFT GENERAL COMPANY, A DIVISION OF AIRCRAFT GENERAL CORPORATION | 131 | 43. AIRCRAFT GENERAL COMPANY, A DIVISION OF AIRCRAFT GENERAL CORPORATION | 131 |
| 47. AIRCRAFT GENERAL COMPANY, A DIVISION OF AIRCRAFT GENERAL CORPORATION | 131 | 44. AIRCRAFT GENERAL COMPANY, A DIVISION OF AIRCRAFT GENERAL CORPORATION | 131 |
| 48. AIRCRAFT GENERAL COMPANY, A DIVISION OF AIRCRAFT GENERAL CORPORATION | 131 | 45. AIRCRAFT GENERAL COMPANY, A DIVISION OF AIRCRAFT GENERAL CORPORATION | 131 |
| 49. AIRCRAFT GENERAL COMPANY, A DIVISION OF AIRCRAFT GENERAL CORPORATION | 131 | 46. AIRCRAFT GENERAL COMPANY, A DIVISION OF AIRCRAFT GENERAL CORPORATION | 131 |
| 50. AIRCRAFT GENERAL COMPANY, A DIVISION OF AIRCRAFT GENERAL CORPORATION | 131 | 47. AIRCRAFT GENERAL COMPANY, A DIVISION OF AIRCRAFT GENERAL CORPORATION | 131 |
| 51. AIRCRAFT GENERAL COMPANY, A DIVISION OF AIRCRAFT GENERAL CORPORATION | 131 | 48. AIRCRAFT GENERAL COMPANY, A DIVISION OF AIRCRAFT GENERAL CORPORATION | 131 |
| 52. AIRCRAFT GENERAL COMPANY, A DIVISION OF AIRCRAFT GENERAL CORPORATION | 131 | 49. AIRCRAFT GENERAL COMPANY, A DIVISION OF AIRCRAFT GENERAL CORPORATION | 131 |
| 53. AIRCRAFT GENERAL COMPANY, A DIVISION OF AIRCRAFT GENERAL CORPORATION | 131 | 50. AIRCRAFT GENERAL COMPANY, A DIVISION OF AIRCRAFT GENERAL CORPORATION | 131 |
| 54. AIRCRAFT GENERAL COMPANY, A DIVISION OF AIRCRAFT GENERAL CORPORATION | 131 | 51. AIRCRAFT GENERAL COMPANY, A DIVISION OF AIRCRAFT GENERAL CORPORATION | 131 |
| 55. AIRCRAFT GENERAL COMPANY, A DIVISION OF AIRCRAFT GENERAL CORPORATION | 131 | 52. AIRCRAFT GENERAL COMPANY, A DIVISION OF AIRCRAFT GENERAL CORPORATION | 131 |
| 56. AIRCRAFT GENERAL COMPANY, A DIVISION OF AIRCRAFT GENERAL CORPORATION | 131 | 53. AIRCRAFT GENERAL COMPANY, A DIVISION OF AIRCRAFT GENERAL CORPORATION | 131 |
| 57. AIRCRAFT GENERAL COMPANY, A DIVISION OF AIRCRAFT GENERAL CORPORATION | 131 | 54. AIRCRAFT GENERAL COMPANY, A DIVISION OF AIRCRAFT GENERAL CORPORATION | 131 |
| 58. AIRCRAFT GENERAL COMPANY, A DIVISION OF AIRCRAFT GENERAL CORPORATION | 131 | 55. AIRCRAFT GENERAL COMPANY, A DIVISION OF AIRCRAFT GENERAL CORPORATION | 131 |
| 59. AIRCRAFT GENERAL COMPANY, A DIVISION OF AIRCRAFT GENERAL CORPORATION | 131 | 56. AIRCRAFT GENERAL COMPANY, A DIVISION OF AIRCRAFT GENERAL CORPORATION | 131 |
| 60. AIRCRAFT GENERAL COMPANY, A DIVISION OF AIRCRAFT GENERAL CORPORATION | 131 | 57. AIRCRAFT GENERAL COMPANY, A DIVISION OF AIRCRAFT GENERAL CORPORATION | 131 |
| 61. AIRCRAFT GENERAL COMPANY, A DIVISION OF AIRCRAFT GENERAL CORPORATION | 131 | 58. AIRCRAFT GENERAL COMPANY, A DIVISION OF AIRCRAFT GENERAL CORPORATION | 131 |
| 62. AIRCRAFT GENERAL COMPANY, A DIVISION OF AIRCRAFT GENERAL CORPORATION | 131 | 59. AIRCRAFT GENERAL COMPANY, A DIVISION OF AIRCRAFT GENERAL CORPORATION | 131 |
| 63. AIRCRAFT GENERAL COMPANY, A DIVISION OF AIRCRAFT GENERAL CORPORATION | 131 | 60. AIRCRAFT GENERAL COMPANY, A DIVISION OF AIRCRAFT GENERAL CORPORATION | 131 |
| 64. AIRCRAFT GENERAL COMPANY, A DIVISION OF AIRCRAFT GENERAL CORPORATION | 131 | 61. AIRCRAFT GENERAL COMPANY, A DIVISION OF AIRCRAFT GENERAL CORPORATION | 131 |
| 65. AIRCRAFT GENERAL COMPANY, A DIVISION OF AIRCRAFT GENERAL CORPORATION | 131 | 62. AIRCRAFT GENERAL COMPANY, A DIVISION OF AIRCRAFT GENERAL CORPORATION | 131 |
| 66. AIRCRAFT GENERAL COMPANY, A DIVISION OF AIRCRAFT GENERAL CORPORATION | 131 | 63. AIRCRAFT GENERAL COMPANY, A DIVISION OF AIRCRAFT GENERAL CORPORATION | 131 |
| 67. AIRCRAFT GENERAL COMPANY, A DIVISION OF AIRCRAFT GENERAL CORPORATION | 131 | 64. AIRCRAFT GENERAL COMPANY, A DIVISION OF AIRCRAFT GENERAL CORPORATION | 131 |
| 68. AIRCRAFT GENERAL COMPANY, A DIVISION OF AIRCRAFT GENERAL CORPORATION | 131 | 65. AIRCRAFT GENERAL COMPANY, A DIVISION OF AIRCRAFT GENERAL CORPORATION | 131 |
| 69. AIRCRAFT GENERAL COMPANY, A DIVISION OF AIRCRAFT GENERAL CORPORATION | 131 | 66. AIRCRAFT GENERAL COMPANY, A DIVISION OF AIRCRAFT GENERAL CORPORATION | 131 |
| 70. AIRCRAFT GENERAL COMPANY, A DIVISION OF AIRCRAFT GENERAL CORPORATION | 131 | 67. AIRCRAFT GENERAL COMPANY, A DIVISION OF AIRCRAFT GENERAL CORPORATION | 131 |
| 71. AIRCRAFT GENERAL COMPANY, A DIVISION OF AIRCRAFT GENERAL CORPORATION | 131 | 68. AIRCRAFT GENERAL COMPANY, A DIVISION OF AIRCRAFT GENERAL CORPORATION | 131 |
| 72. AIRCRAFT GENERAL COMPANY, A DIVISION OF AIRCRAFT GENERAL CORPORATION | 131 | 69. AIRCRAFT GENERAL COMPANY, A DIVISION OF AIRCRAFT GENERAL CORPORATION | 131 |
| 73. AIRCRAFT GENERAL COMPANY, A DIVISION OF AIRCRAFT GENERAL CORPORATION | 131 | 70. AIRCRAFT GENERAL COMPANY, A DIVISION OF AIRCRAFT GENERAL CORPORATION | 131 |
| 74. AIRCRAFT GENERAL COMPANY, A DIVISION OF AIRCRAFT GENERAL CORPORATION | 131 | 71. AIRCRAFT GENERAL COMPANY, A DIVISION OF AIRCRAFT GENERAL CORPORATION | 131 |
| 75. AIRCRAFT GENERAL COMPANY, A DIVISION OF AIRCRAFT GENERAL CORPORATION | 131 | 72. AIRCRAFT GENERAL COMPANY, A DIVISION OF AIRCRAFT GENERAL CORPORATION | 131 |
| 76. AIRCRAFT GENERAL COMPANY, A DIVISION OF AIRCRAFT GENERAL CORPORATION | 131 | 73. AIRCRAFT GENERAL COMPANY, A DIVISION OF AIRCRAFT GENERAL CORPORATION | 131 |
| 77. AIRCRAFT GENERAL COMPANY, A DIVISION OF AIRCRAFT GENERAL CORPORATION | 131 | 74. AIRCRAFT GENERAL COMPANY, A DIVISION OF AIRCRAFT GENERAL CORPORATION | 131 |
| 78. AIRCRAFT GENERAL COMPANY, A DIVISION OF AIRCRAFT GENERAL CORPORATION | 131 | 75. AIRCRAFT GENERAL COMPANY, A DIVISION OF AIRCRAFT GENERAL CORPORATION | 131 |
| 79. AIRCRAFT GENERAL COMPANY, A DIVISION OF AIRCRAFT GENERAL CORPORATION | 131 | 76. AIRCRAFT GENERAL COMPANY, A DIVISION OF AIRCRAFT GENERAL CORPORATION | 131 |
| 80. AIRCRAFT GENERAL COMPANY, A DIVISION OF AIRCRAFT GENERAL CORPORATION | 131 | 77. AIRCRAFT GENERAL COMPANY, A DIVISION OF AIRCRAFT GENERAL CORPORATION | 131 |
| 81. AIRCRAFT GENERAL COMPANY, A DIVISION OF AIRCRAFT GENERAL CORPORATION | 131 | 78. AIRCRAFT GENERAL COMPANY, A DIVISION OF AIRCRAFT GENERAL CORPORATION | 131 |
| 82. AIRCRAFT GENERAL COMPANY, A DIVISION OF AIRCRAFT GENERAL CORPORATION | 131 | 79. AIRCRAFT GENERAL COMPANY, A DIVISION OF AIRCRAFT GENERAL CORPORATION | 131 |
| 83. AIRCRAFT GENERAL COMPANY, A DIVISION OF AIRCRAFT GENERAL CORPORATION | 131 | 80. AIRCRAFT GENERAL COMPANY, A DIVISION OF AIRCRAFT GENERAL CORPORATION | 131 |
| 84. AIRCRAFT GENERAL COMPANY, A DIVISION OF AIRCRAFT GENERAL CORPORATION | 131 | 81. AIRCRAFT GENERAL COMPANY, A DIVISION OF AIRCRAFT GENERAL CORPORATION | 131 |
| 85. AIRCRAFT GENERAL COMPANY, A DIVISION OF AIRCRAFT GENERAL CORPORATION | 131 | 82. AIRCRAFT GENERAL COMPANY, A DIVISION OF AIRCRAFT GENERAL CORPORATION | 131 |
| 86. AIRCRAFT GENERAL COMPANY, A DIVISION OF AIRCRAFT GENERAL CORPORATION | 131 | 83. AIRCRAFT GENERAL COMPANY, A DIVISION OF AIRCRAFT GENERAL CORPORATION | 131 |
| 87. AIRCRAFT GENERAL COMPANY, A DIVISION OF AIRCRAFT GENERAL CORPORATION | 131 | 84. AIRCRAFT GENERAL COMPANY, A DIVISION OF AIRCRAFT GENERAL CORPORATION | 131 |
| 88. AIRCRAFT GENERAL COMPANY, A DIVISION OF AIRCRAFT GENERAL CORPORATION | 131 | 85. AIRCRAFT GENERAL COMPANY, A DIVISION OF AIRCRAFT GENERAL CORPORATION | 131 |
| 89. AIRCRAFT GENERAL COMPANY, A DIVISION OF AIRCRAFT GENERAL CORPORATION | 131 | 86. AIRCRAFT GENERAL COMPANY, A DIVISION OF AIRCRAFT GENERAL CORPORATION | 131 |
| 90. AIRCRAFT GENERAL COMPANY, A DIVISION OF AIRCRAFT GENERAL CORPORATION | 131 | 87. AIRCRAFT GENERAL COMPANY, A DIVISION OF AIRCRAFT GENERAL CORPORATION | 131 |
| 91. AIRCRAFT GENERAL COMPANY, A DIVISION OF AIRCRAFT GENERAL CORPORATION | 131 | 88. AIRCRAFT GENERAL COMPANY, A DIVISION OF AIRCRAFT GENERAL CORPORATION | 131 |
| 92. AIRCRAFT GENERAL COMPANY, A DIVISION OF AIRCRAFT GENERAL CORPORATION | 131 | 89. AIRCRAFT GENERAL COMPANY, A DIVISION OF AIRCRAFT GENERAL CORPORATION | 131 |
| 93. AIRCRAFT GENERAL COMPANY, A DIVISION OF AIRCRAFT GENERAL CORPORATION | 131 | 90. AIRCRAFT GENERAL COMPANY, A DIVISION OF AIRCRAFT GENERAL CORPORATION | 131 |
| 94. AIRCRAFT GENERAL COMPANY, A DIVISION OF AIRCRAFT GENERAL CORPORATION | 131 | 91. AIRCRAFT GENERAL COMPANY, A DIVISION OF AIRCRAFT GENERAL CORPORATION | 131 |
| 95. AIRCRAFT GENERAL COMPANY, A DIVISION OF AIRCRAFT GENERAL CORPORATION | 131 | 92. AIRCRAFT GENERAL COMPANY, A DIVISION OF AIRCRAFT GENERAL CORPORATION | 131 |
| 96. AIRCRAFT GENERAL COMPANY, A DIVISION OF AIRCRAFT GENERAL CORPORATION | 131 | 93. AIRCRAFT GENERAL COMPANY, A DIVISION OF AIRCRAFT GENERAL CORPORATION | 131 |
| 97. AIRCRAFT GENERAL COMPANY, A DIVISION OF AIRCRAFT GENERAL CORPORATION | 131 | 94. AIRCRAFT GENERAL COMPANY, A DIVISION OF AIRCRAFT GENERAL CORPORATION | 131 |
| 98. AIRCRAFT GENERAL COMPANY, A DIVISION OF AIRCRAFT GENERAL CORPORATION | 131 | 95. AIRCRAFT GENERAL COMPANY, A DIVISION OF AIRCRAFT GENERAL CORPORATION | 131 |
| 99. AIRCRAFT GENERAL COMPANY, A DIVISION OF AIRCRAFT GENERAL CORPORATION | 131 | 96. AIRCRAFT GENERAL COMPANY, A DIVISION OF AIRCRAFT GENERAL CORPORATION | 131 |
| 100. AIRCRAFT GENERAL COMPANY, A DIVISION OF AIRCRAFT GENERAL CORPORATION | 131 | 97. AIRCRAFT GENERAL COMPANY, A DIVISION OF AIRCRAFT GENERAL CORPORATION | 131 |



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